TECHNOLOGICAL CONTINUITIES AND SPECIALIZATION IN PREHISTORIC METALWORK IN THE EASTERN UNITED STATES

By

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Abstract of Dissertation Presented to the Graduate School of the University of Florida in Partial FulFillment of the Requirements for the Degree of Doctor of Philosophy

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By

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Chairman: Dr. Michael Moseley
Major Department: Anthropology

This study defines the level of copper technology in the eastern United States, clarifies some misunderstandings concerning Indian metalworking technology, identifies technological continuities, and addresses the issue of specialization as it pertains to copper during the Late Archaic, Middle Woodland, and Mississippian time periods. Three copper collections are analyzed to provide this information, the Old Copper Industries of the Great Lakes region (Late Archaic), the Hopewell site of the Ohio Valley (Middle Woodland), and the Etowah site of north Georgia (Mississippian). The latter collection is supplemented by analysis of metal artifacts from the Lake Jackson site near

Tallahassee, Florida, and the Fort Center site, in Glades County, Florida.

A four-fold approach based on re-evaluation of prior analyses, basic technometric analysis, xeroradiography, and experimental archaeology is used to elucidate the research goals. A total of one thousand three hundred and seventy-three artifacts from the collections are analyzed using the techniques outlined above. The resulting data and interpretations from each period are presented and synthesized. Discussions of specialization and metal use by societies of differing levels of complexity are presented and future areas of research are identified.

CHAPTER ONE
INTRODUCTION

This study defines the level of prehistoric copper technology in the eastern United States, clarifies some of the areas of misunderstanding, identifies technological continuities, and addresses the issue of specialization as it pertains to copper working during the Late Archaic, Middle Woodland, and Mississippian time periods. Copper working in these three periods is analyzed using collections from various sites: Late Archaic (the Old Copper Industries collection of the Great Lakes region), Middle Woodland (the Hopewell site collection of the southern Ohio), and Mississippian (the Etowah site collection of North Georgia).

Prehistoric peoples of the eastern United States worked metal into a variety of artifacts. Academic analyses of these metal artifact assemblages have been on-going for more than a century (Jones 1873; McGuire 1903; Holmes 1919; Griffin 1961; Quimby 1963; Patterson 1971; Phillips and Brown 1978; Goad 1976, 1979, 1983), and, as might be expected, reflect varying goals irrespective of the technological levels of the artifacts (Willey and Sabloff 1980:1-11). In the late years of the last century the focus

was to determine whether the ancestors of native American populations were capable of producing complex artifacts, including those made from copper and other metals (Jones 1873; Moore 1894a, 1894b; Cushing 1894; McGuire 1903). Resulting analytical and experimental work provided a consensus on the basic techniques utilized by prehistoric peoples (Holmes 1919; Wilson and Sayer 1935; Frank 1951; Schroeder and Ruhl 1968; Fraikor, Hester, and Fraikor 1971; Vernon 1985). Basic metal-forming techniques identified include cold working, hot forging, annealing, grinding, and rolling tube beads over mandrels.

The level of technical ability was not adequately addressed by these and subsequent analyses. Instead, past analyses have tended to be relatively simple determinations of the range of metallurgical processes used by a specific group. Such a determination of basic metallurgical processes is an important first step. It does not explain, however, the manner in which these processes were put to use by the group (Patterson 1971; Vernon 1985). This is a vital point, since it is the manipulation of technical processes and their products that provides archaeologically relevant information. One current concern is the identification of specialists within a group. Specialists are by definition intimately connected to the manipulation of manufacturing processes, not to the basic processes alone (Evans 1978; Rice 1981; Prentice 1983, 1985; Yerkes 1983; Muller 1984;

Pauketat 1987). The data derived by this analysis are used to address the possibility of metalworking specialists during the three time periods.

In this study research proceeded in four steps. The first step was a review of earlier research. While the majority of analyses of native American metalwork have been narrowly focused and non-integrative in nature, pertinent information is often contained in these studies and can be reapplied. Several of the studies were made in the late nineteenth century, and while the techniques and methods are simple by our present standards they should not be automatically rejected. The best analysis techniques are not always the latest, most complex, or the most expensive. The unwitting embrace of earlier biases and misapplications often included in these early studies must be scrupulously guarded against (Binford 1962; Caley 1967). This is a common problem when dealing with technical research topics. Few archaeologists are trained in either metallurgy or metalworking. Even fewer metallurgists or artisans are trained in the concerns and methodologies of archaeology. Archaeology is primarily a social science and technical studies must be integrated with the interpretations of the societies that produced the artifacts under study (White 1959:24).

Basic technometric analysis, which has been a mainstay of archaeology since its foundation (Brothwell and

Higgs 1970), was the second step in the analysis. Technometric analysis includes the recording of primary measurements such as length, width, thickness, weight, and surface features. It is surprising how many collections have yet to be analyzed at this rudimentary level. Fabrication technique patterns, among other things, are often apparent at this level. How much greater would our understanding be, if accurate measurements and observations had been made at some time close to the excavation of these major sites?

Collections used for this study required basic technometric analysis, except for the Hopewell site collection which is being measured as a part of an exhaustive catalog (Essenpreis and Greber n.d.). A total of one thousand three hundred and seventy-three artifacts from Archaic Period (Old Copper Industries), Middle Woodland Period (Hopewell site), and Mississippian Period (Etowah site) collections were analyzed. The basic technometric data derived from these artifacts are included as Appendices A, B, and C.

Analysis techniques have become increasingly more complex, esoteric, and expensive. It is necessary for the archaeologist to be able to discriminate carefully between competing forms. The traditional technique for analyzing metal manufacture is stereology (Schrager 1969; Brothwell and Higgs 1970; Tite 1972). Stereology allows for the

identification of micro-attributes such as annealing twins, alloy diffusion, and crystal size. There are several distinct disadvantages to using stereology. Physical invasion of the artifact to remove a piece of metal for polishing, etching, and mounting is one of them. Destruction of unique, non-replaceable artifacts should be avoided, a point agreed upon by most curators. Time is another constraint. Proper removal, polishing and etching of the test piece requires several hours. Volume testing by this technique is laborious, long, and expensive. There is another potential problem at the conclusion of the test. Interpretation of the resulting micro-field view is open to individual bias and sampling error (Schrager 1969; Tite 1972; Neiburger 1984). This study will use the stereological analyses of the past, corrected as necessary, but will concentrate on a different technique.

Xeroradiography is a technique that has assumed a greater degree of importance in studying metals in recent years (Lechtman, Parsons, and Young 1975; Alexander and Johnston 1982; Neiburger 1984; Leader 1985). Unlike stereology, the preparation of artifacts for xeroradiography is minimal and non-invasive. Sampling errors, a concern with any limited field test, are mitigated by testing the entire artifact. Fabrication techniques are determined by macro-attributes. Patterns that may be obscured in stereological micro-analysis through sampling error or

deformation may be visible in xeroradiographical macro-analysis. In situ contact between metal artifacts may be identified (in some cases) during xeroradiography through metal density changes invisible to microscopic analysis or the unaided eye (Leader 1985). Repair and reconstruction of artifacts either in antiquity or in modern times can also be identified. Large numbers of whole artifacts can be tested.

Xeroradiography, with all the positive attributes mentioned above, does not supplant stereology as a technique. They are both highly effective at what they do; the analysis of metal artifacts at either the micro or macro level. It is up to the researcher to determine which technique is applicable for the test at hand. Size of the three collections, uniqueness of the pieces, and constraints upon the amount of time to be spent in analysis all support xeroradiography as the technique of choice for this study.

The fourth part of the research was based on experimental archaeology. Experimental archaeology is not new to the discipline, although it is often misapplied (Heyerdahl 1950, 1958, 1971). The purpose of experimental archaeology is to test or narrow the acceptable parameters of human behavior through the use of controlled experiment (Coles 1973). Limitations of this form of analysis must be kept firmly in mind. First is that the tests do not "prove" anything. They can only demonstrate a relative ability and competency from which a probabilistic statement may be made

concerning use. This syllogism will always be subject to further refinement. Secondly, a controlled experiment is by necessity a simplified experiment. Great care must be used to ensure that the experiment being undertaken does not oversimplify the reality being tested, or that the information derived from the experiment is not used to support contentions which were not tested. Nonetheless, information derived from experimental archaeology can be very useful in refining archaeologists' understanding of a society's use of technology.

Experiments done as a part of this analysis focused on several points of interest. These included identifying tool markings and wear patterns, determining the relationship of work hardening and annealing to the function of Archaic copper socketed spearpoints, and identifying alternative methods for manufacturing Middle Woodland hollow copper bracelets and cut-outs. Work hardening refers to loss of flexibility in a copper artifact by hammering or compressing the artifact. The copper crystals in the artifact are compacted and deformed during work hardening, which is what causes the loss of malleability. Heating the metal anneals it, causing the crystal structure to become less compact and stressed. Annealing returns the metal to a soft and flexible state.

In summary, the purpose of this study is to define the level of copper technology in the eastern United States,

clarify some of the areas of misunderstanding, identify technological continuities, and address the issue of specialization as it pertains to copper during the Late Archaic, Middle Woodland, and Mississippian time periods. Three copper working societies are analyzed to provide this information, the Old Copper Industries of the Great Lakes region (Late Archaic), the Hopewell site of the Ohio Valley (Middle Woodland), and the Etowah site of North Georgia (Mississippian). A four-fold approach based on the re-evaluation of prior analyses, basic technometric analysis, xeroradiography, and experimental archaeology is used to elucidate the research goals. A total of one thousand three hundred and seventy-three artifacts from the collections were analyzed using the techniques outlined above. The resulting information and data regarding the research topics will be presented in the discussions that follow.

CHAPTER TWO
ARCHAEOLOGICAL BACKGROUND

The metal collections that provide the data for our discussion represent three different time periods in eastern United States prehistory. A brief sketch of these time periods and their salient points is presented below.

Paleoindian Period

The Paleoindian period precedes the time periods of this study. At the present, it is thought that the Paleoindian period extends from approximately 9500 B.C. to 6500 B.C. Subsistence patterns during this period were based on megafauna hunting strategies supplemented by the gathering of wild plants (Wilmsen 1974). Transhumant wandering is thought to be the common mode for Paleoindian groups (Quimby 1960; Griffin 1983; Muller 1983). The tool kits used by these hunting and gathering groups included both Clovis and Folsom points, a part of the greater fluted point and Plano complexes. Materials used in the manufacture of these stone tools were predominately of local origin, although some exotic materials not readily available have been identified (Witthoft 1952; Fitting 1968; Ritchie 1969; Purdy 1981; Griffin 1983).

The inclusion of non-local lithic materials, albeit in minor amounts, is significant. It has been suggested that the trade networks, which are so abundantly evident in the Woodland and Mississippian time periods, had their start during Paleoindian period (Goad 1978) although Milanich and Fairbanks (1980) suggest that the beginnings of this trade are more accurately identified with the Archaic. Ritchie (1969) sees the inclusion of non-local lithic materials as being an indication of the transhumant wandering lifestyle, rather than the result of trade. Climatic conditions at the end of the Wisconsin Glaciation are interpreted as the impetus for groups to travel outside their normal boundaries, resulting in a scattering of non-local materials that they had carried with them. The inclusion of non-local materials in various sites is probably a combination of effects including reciprocal trade (Fitting 1966; Wilmsen 1974), chance encounters with other groups during hunting (Witthoft 1952), and fluctuating itineraries (Ritchie 1969).

Archaic Period

The Archaic time period extends from 6,500 B.C. to 1,000 B.C. Subsistence strategies shifted during the Early Archaic from the transhumant hunting and foraging of the preceding Paleoindian epoch. A reason for this shift can be explained partially by the environment. The climate in the eastern United States became warmer and dryer at the end of the Wisconsin Glaciation. This climatic change resulted in

a rise in sea level, new coastal configurations, and the transformation or outright disappearance of habitats. The larger megafauna of the Paleoindian period was slowly replaced during the Archaic period by smaller game species that expanded into the boreal environment. Human responses to these changes were varied. Regional exploitation of resources rather than transhumant wandering became more common. Archaic period societies are believed to have engaged in a band structure (Service 1962; Griffin 1983:255; Bender 1985). Bands are defined as egalitarian kin based groups with informal/diffuse decision making (Service 1975:60-61).

Plant resources assumed a greater importance, and a seasonally cyclic, semi-nomadic lifestyle evolved based on the availability of wild fruits, nuts and plants. Shellfish were exploited and the many shell mounds in various locations throughout the eastern United States bear testimony to the use of this resource. Tool kits expanded during the Archaic and changed to reflect the broader range of activities taking place (Purdy 1981; Griffin 1983).

Ground stone tools and stemmed points are indicative of the Middle Archaic period (Purdy 1981; Griffin 1983:248). Split and carved bone artifacts are often encountered within the artifact assemblage in the form of awls and fish hooks. A dependence on gathered resources was coming to dominate the subsistence base. In the Late Archaic, exotic items

made of copper from the Great Lakes Region and salt water shell from the Gulf become an increasingly common inclusion in burials, which were often placed in preexisting gravel/sand knolls (Quimby 1960; Fitting 1975; Goad 1978; Milanich and Fairbanks 1980; Griffin 1983). This burial activity in natural knolls presages the common form of interment in artificial earthen mounds characteristic of later periods. Fiber tempered pottery is used as an arbitrary marker for this period's end.

The copper artifacts recovered by early researchers from burials, isolated finds lost through mis-adventure, or secreted in caches, were initially thought to represent a single Old Copper Culture (Mcguire 1903; Quimby 1960; Griffin 1961, 1983; Fitting 1975). The idea that a single "culture" produced the copper implements of this time period has been shown to be erroneous. The areal extent of the Old Copper Industries is much too large to represent the products of a single culture (Mason and Mason 1961; Fitting 1975; Griffin 1983). These copper producing groups have not been well differentiated, and are generally distinguished primarily by geographic area and artifact taxonomy. The lack of clear syntheses for each group, due to the lack of data, hampers the discussion of metal use by these groups. General statements of use and integration of metal in these social systems is possible, but only with the clear understanding that the specific application of these

statements may vary widely between the groups (Griffin 1983; Vernon 1985). Nonetheless, the data so derived can be used to track continuities in metalworking and to help identify shifts in technique emphasis over time.

A difference of opinion exists over the actual usage of many of the copper artifacts identified as being a part of the general assemblage of the Old Copper Industries. Initial investigators (Holmes 1919; Quimby 1960, 1963; Griffin 1961, 1983) identified the copper artifacts as utilitarian items rather than ornamental or ceremonial in function. However, there are an increasing number of people who prefer to view the materials as indicators of social status (Binford 1962; Goad 1978; Vernon 1985). This alternative view is based on the inclusion of copper within the increasingly complex exchange networks of this time, and on physical/economic characteristics of the manufacture and use of the tools themselves. There is a certain amount of validity to both points of view, neither of which are mutually exclusive. The insistence of exclusiveness by some of these authors is more an indicator of the general misapplication of western scientific rationales to non-western technologies than of an intrinsic reality (Leader 1986). This discussion will be developed further in the next chapter.

Woodland Period

The Woodland time period extends from 1000 B.C. to A.D. 900. The fiber tempered pottery that had appeared at the end of the Late Archaic was replaced by a proliferation of forms and tempers during the Woodland. Prior to the introduction of carbon 14 analysis, pottery types were a major means of developing relative chronologies. Pottery is also an indication of the stabilization of the subsistence shifts from the Paleoindian through the Archaic periods. Pottery vessel use is intimately connected to sedentary lifestyles, and a dependence on local resources. The shift to regional exploitation of resources intensified the reliance on smaller swifter game and eventually produced the bow and arrow late in this time period.

Woodland societies are thought to have formed tribal groups (Braun and Plog 1982:515-518; Griffin 1983:261; Muller 1983:387-389). A tribe is essentially a social network that can have internal ranking, but is usually considered to be unstratified. Social institutions may be recognized and extend through a large number of the residences. The increase in the number and size of habitations is thought to be one indicator of this situation. Habitation sites tend to be located at the intersections of rich biotic communities, such as the high land near river floodplains or marsh. Some sites are characterized by a large size, monumental architecture, and

abundance of elite materials. These elaborations have been attributed in part to the stimulus of trade (Goad 1978).

There can be no doubt that exchange networks proliferated during the Woodland period, or that some of the larger sites within the networks are quite astounding for their complexity and richness of materials. Alligator teeth, and fossil shark teeth, grizzly bear canines and claws, fresh and saltwater shell, pearls, Knife River chalcedony, mica, obsidian, quartz, galena, graphite, hornstone chert, steatite, meteoric iron, silver, and copper represent the majority of elite materials distributed through one network, the Hopewell Interaction Sphere (Caldwell 1964; Carlson 1979).

The actual meaning of the synthetic concept, the Hopewell Interaction Sphere, is open to debate. Caldwell (1964), who coined the term, saw the concept as an effective way to identify the logistic exchange of shared exotic materials (finished or unfinished) between very different expressions of regional systems. A primary goal of his work was to differentiate between the seemingly similar mortuary treatments and varied secular forms of the regional groups involved in the network. Ideas and information are considered a part of this network and were manufactured, in part, by shared symbols (Caldwell 1964; Streuver and Houart 1972). Research emphasis on the shared traits has tended to obscure the very different basic expressions of the groups

that interacted within this network at very different levels of participation (Streuver and Houart 1972; Jefferies 1976; Goad 1978, 1983; Griffin 1979; Seeman 1979). The actual mechanism used to acquire the resources is unknown. However, several suggestions have been made including itinerant traders based in the Ohio Valley (Griffin 1965). Regardless of the mechanism, researchers agree that the most sophisticated group in the network was based in the central Scioto valley of Ohio with the Hopewell site as one of the preeminent sites in Ohio (Prufer 1964; Flannery 1968; Walthall and Keel 1974; Goad 1978). Seeman (1979:411) provides a cogent warning concerning the level of the suggested exchange network. He points out that the situation is very one sided with the majority of materials coming into the Ohio valley and staying there.

The majority of the copper artifacts found at the Hopewell site are distinctly different from those that were produced during the Archaic period. A refinement of technique and an increase in the variety of techniques and non-utilitarian forms is very evident. This shift in emphasis has been explained as a result of increasing complexity within the individual society and possible elaboration or formalization of contacts within the pre-existing network, resulting in a shift of the copper artifacts from utilitarian goods to markers of status (Binford 1962; Dragoo 1964; Brose 1979; Seeman 1979), even

though a precise definition of this status is not yet available (Griffin 1979). It is interesting to note that the artifacts identified with this network were exchanged in small amounts. The majority of the materials were kept at the site where they were made and not spread over the surrounding countryside (Seeman 1979; Goad 1983).

The Hopewell site and the general use of copper artifacts declined during the Late Woodland period. Several suggested causes that have been advanced by various authors include cultural fatigue, climatic change, warfare, and disruption of the networks that are thought to have supported the elaborate social displays (Griffin 1952, 1960; Prufer 1964; Vickery 1970). Muller (1983) suggests that the decline is more apparent than real. He views the situation as an internal shift of emphasis with a resulting loss of outwardly directed display. None of these explanations are very satisfying, and in the case of climate change the analysis is apparently inaccurate. For whatever reasons, there was a decline in elite materials and tangible remains of social elaboration that was not mitigated until the Mississippian period approximately 500 years later.

Mississippian Period

The Mississippian time period extends from A.D. 900 to European contact. Unlike the preceding time periods, historic accounts are available for some of the groups dominant during this time period. Several Spanish

expeditions passed through the southeastern United States resulting in contacts with the indigenous societies and accounts of their activities (Fontaneda 1945; Smith 1968; DePratter and Smith 1980; Smith 1987). Based upon these historic accounts, with additional support from excavation and survey, some of the societies of this time period are considered to be chiefdoms (Brown 1971; Steponaitis 1978; Muller 1983:403). Chiefdoms are defined as societies with centralized control over domestic economy through the ascribed hereditary office of the chief (Sahlins 1972:132-148).

Horticulture has precedents from the Woodland period; however, it is not until the Mississippian period that maize agriculture becomes a valuable resource (Griffin 1983; Muller 1983). Maize agriculture is important to this time period, and to the discussion of the societies included within it.

The emphasis placed on a stable subsistence base comprised of storable materials is intimately intertwined with archaeologist's expectations concerning specialists and specialization. Childe (1951) codified this expectation by stating that occupational specialization was the result of excess subsistence goods that could be stored and transported, the idea being that this excess material would allow for the freeing of specific individuals to pursue full time specialization. While Childe (1951:71, 80, 97)

believed the roots of specialization extended to a time prior to the occurrence of large scale surplus, he clearly saw these earlier forms as sporadic and of minor importance. His synthetic statement of what would comprise a social level capable of supporting specialization includes centralized authority and an agricultural base (Childe 1951:35, 80, 92,; see also Braidwood 1967:136-138; Braun and Plog 1982:504). While archaeology as a discipline has become much more aware of the complexities of the situation, the philosophical baggage that formulated Childe's definition can still be seen today (cf., Muller 1984; Pauketat 1986). The current debate concerning Mississippian specialization and the validity of the concept of "cottage" industries versus full time centralized industries illustrates this point (Yerkes 1983; Prentice 1983, 1985; Muller 1984; Pauketat 1986). Specialists and specialization will be discussed in greater detail in chapter six.

The Southeastern Ceremonial Complex is a striking marker for the Mississippian time period (Waring and Holder 1945; Waring 1968; Howard 1966). The Southeastern Ceremonial Complex is a synthesis of themes and motifs executed in a number of media that demonstrate not only the long-standing exchange networks in the Southeast, but probable social interaction in some cases (Muller 1983:411). Three archaeological sites are intimately bound to this concept, the Spiro site in Oklahoma, the Etowah site in

Georgia, and the Moundville site in Alabama. The Etowah site is considered to best illustrate the majority of the traits that have been identified as being part of the Southeastern Ceremonial Complex (Waring and Holder 1945).

Initially, it was thought that the impetus for the Southeastern Ceremonial Complex came from Mexico; however, this is probably not the case (Krieger 1945). The majority of motifs and themes used by the Southeastern Ceremonial Complex already existed in the area and had been manipulated to varying extents in similar media in former times. The re-organization of these motifs and themes plus the variations in design have stimulated many interpretive studies (Hamilton, Hamilton, and Chapman 1975; Phillips and Brown 1978; Prentice 1984).

Copper continued to play an important role as a medium for the expression of symbolic content in the Southeastern Ceremonial Complex. Many of the techniques in copper working that first appear during the Woodland period continue to be used at this time. However, there are several distinctive shifts in preferred techniques. These shifts will be discussed in chapter five.

Copper Artifacts

Technology, and the fruits of that technology, cannot be studied separately from the society that produced them. The foregoing brief discussion of salient points concerning the time periods represented by metal collections

was presented as a means of outlining features characteristic of these periods. Much of the shifting emphases identified in manufacturing and use of copper artifacts in later chapters can be tied to social and economic shifts within the societies themselves. Nevertheless, there are some technological shifts that do not lend themselves to easy explanation, and apparently contradict the general expectations. These contradictions are identified at the appropriate places and discussed in detail. The next section of this chapter provides a brief background for each of the primary collections used in this study.

Collections Analyzed

The metal collection for the Archaic Old Copper Industry, provided by the Field Museum of Natural History, Chicago, has relatively good provenience information. Usually, provenience data for Old Copper Industry artifacts are problematical at best. This is due to the fact that the majority of Archaic copper artifacts were recovered by non-archaeologists, primarily farmers or workmen from the states of Wisconsin, Michigan, and Indiana involved in other activities that brought them in accidental contact with the copper artifacts. The Wyman brothers were dealers in antiquities who travelled throughout the Midwest and bought the copper artifacts wherever they could. They then sold the Archaic copper artifacts contained in the collection to

the Field Museum during the late 1800s and early 1900s. The Wyman Brothers appear to have been unusual for the time. Notes as to place, manner, and circumstances of recovery are common, although they vary drastically as to completeness and scientific utility. Appendix A contains the provenience data available for the one hundred and eighty-five Old Copper Industry artifacts analyzed in this study.

A few metal caches are included in this collection, providing in depth information not possible from single finds. Isolated finds were used to increase the database for general statements concerning function and manufacture.

It is very probable that other exchange goods such as steatite and shell were included in the sale lots by the Wyman brothers. Unfortunately, it has not been possible to identify any other materials that might have been included in the caches or burials. This is the only collection used in this study for which this problem obtains. The final section of this chapter addresses itself to the probable sources for the elite materials included in the collections.

The main depository for the Hopewell site collection is the Field Museum, Chicago. The Hopewell site is located on the North Fork of Paint Creek in Ross county, Ohio, near the present city of Chillicothe. Caleb Atwater (1820) first brought this site to the attention of the scientific community. His brief description and sketch map induced E.G. Squier and E.H. Davis to include the site in

their survey of the ancient monuments of the Mississippi valley (Squier and Davis 1848:24-29). Squier and Davis mapped the site and conducted limited excavations in at least five of the mounds. Warren K. Moorehead engaged upon a much more extensive investigation of the thirty-eight mounds located on the site during 1891 and 1892 (Moorehead 1922). The purpose of his excavation was to provide material for the 1893 Columbian Exposition held in Chicago. A large quantity of material was recovered from the site, including five thousand copper artifacts by Moorehead's own estimate. Moorehead's style of excavation and site recording was considered to be somewhat less than desirable by his own colleagues. In 1922-25, Henry Shetrone excavated at the Hopewell site. His purpose was to further the investigation of the site and to verify certain details reported by Moorehead (Shetrone 1926:90). Shetrone recovered less material than Moorehead from the site, but still a significant amount. This was notwithstanding the fact that the owner had destroyed large portions of the site under the erroneous belief that Moorehead had removed all the important materials (Shetrone 1926:91). Unfortunately, they also discovered that Moorehead had inadvertently misplaced several of the mounds and confused artifact lots between mounds. After this excavation little additional work has been done at the site. Shetrone's material was placed in the keeping of the Ohio Historical Society. Over

the years, pieces have been traded or loaned between the Ohio Historical Society and the Field Museum. A third collection, that of Squier and Davis, resides at the British Museum. Due to time constraints and availability only the collection at the Field Museum was used as part of this study.

The Hopewell site collection is the best example of Middle Woodland period metalwork, making it indispensable for this study. Appendix B provides information concerning the artifacts tested from the collection.

The Etowah Mound site is located in Bartow county near the city of Cartersville, Georgia, and consists of three large mounds faced by an arc of six smaller mounds. A borrow pit, resulting from the construction of the large mounds, was mistaken for a fish pond or moat at one time (Larson personal communication). Etowah was occupied between A.D. 700 and 1650 (Larson 1971). The nine mounds have been a focal point of interest for many years and figured prominently in the early Mound Builder controversy (Jones 1873; Thomas 1894). The Mound Builders were a mythical race of socially advanced people, probably white, who were credited with building the mounds in the eastern United discovered by eighteenth and nineteenth century European explorers (Willey and Sabloff 1980). Proponents of the Mound Builder explanation could not accept the idea that the Indians of the eastern United States were capable of

monumental architecture. Rather, they saw the Indians as destroyers of the Mound Builder race. The Mound Builder myth were debunked by Cyrus Thomas (1894), but vestiges remain to the present day.

Initial work was limited in scope but indicative of the richness of the site (c.f., Thomas 1894). Eleven burials were discovered in Mound C during an excavation under the auspices of Cyrus Thomas (Thomas 1894). Grave goods included shell, copper, and marble statues. Although John Rogan, Thomas' field supervisor, claimed to have fully excavated the mound to its natural level, this was not the case. The successive building of the mound using thick mantles, coupled with an erroneous assumption that the mound had started as a natural feature, fortuitously left a portion of the mound intact. A similar error occurred during the much more extensive work done by Warren K. Moorehead (Moorehead 1932; Kelly and Larson 1956).

Although Moorehead was mistaken about the extent of his excavation of Mound C, his excavations of the site in 1925, 1926, and 1927 were more thorough then the work undertaken by Rogan. Moorehead's excavations were accomplished by unskilled hired laborers (from either Cartersville or the Tumlins' tenant farmers). Moorehead extensively excavated Mound C, tested Mound B, and tested several portions of the village area both east and west of Mound A. Burials and materials of note were often uncovered

and left for Moorehead's later analysis due to his overextended excavation strategy. Time limitations and the need for the owners to farm the land caused Moorehead difficulties. Site stratigraphy was noted only in a general way because of the lack of time. The removal of key stakes by the tenant farmers prevented an accurate site map from being made. Moorehead resorted to numerous auger tests in the latter phases of the field work to test areas not excavated for lack of time. The recovered materials from these activities were widely dispersed to both public and private collections, including the Smithsonian Institution and Philips Academy, Andover. His 1932 publication, The Etowah Papers, is the only collected account of his work at the site.

In 1953, William Sears tested the site for the Georgia Historical Commission in order to produce a chronology for the site and help to determine the extent and nature of the cultural materials. The next year Lewis Larson was asked by the same commission to determine the original angle of Mound C's sides and the dimensions of its base in preparation for rebuilding the mound. Like Moorehead's excavation Larson's first excavation at Etowah produced substantial finds, revealing the extent of the materials left behind by the earlier excavators. Several seasons of excavation at Mound C and the village area east of Mound A followed Larson's initial discovery. Mound C was

leveled, sub-mound excavations were undertaken, and then the mound was rebuilt to the height and shape postulated for the time period represented by the fourth construction phase.

Larson's work at Mound C resulted in the recovery of two hundred and forty-four graves that were mapped in situ. Many of these graves contained elite materials made from shell, bone, stone, and metal. Seven sub-mound public structures were discovered and mapped, and the fragmentary remains of charnel structures from the surviving mantles left by Moorehead were identified. The quantity and diversity of materials recovered was overwhelming. A multi-disciplinary research team, clearly necessary to adequately analyze the site, has been slow in forming. The present study attempts to redress a portion of this situation.

Elite Materials

The elite materials found at both the Hopewell and Etowah sites include alligator teeth, fossil and fresh shark teeth, grizzly bear claws and canines, fresh and salt water shell, pearls, mica, quartz, greenstone, steatite, cannel coal, graphite, galena, meteoric iron, silver, copper and copper carbonate. Materials found only at the Hopewell site include Knife River chalcedony, obsidian, and hornstone chert. In addition to the materials mentioned above, the Etowah site has kaolin, marble, and ochre. The majority of materials are shared between the two sites allowing for an integrated discussion of material sources.

It is interesting that the majority of the exotic materials found at the Etowah site are located within a one hundred mile radius. Indeed, a number of elite materials (red ochre, kaolin clay, pearls, mother-of-pearl, and greenstone) are found within 10 miles of the site. The Hopewell site, on the other hand, appears to have collected its materials from much farther afield. The Etowah site enjoyed an advantageous placement at the physiographic edge of a number of diverse ecosystems, specifically the Piedmont and Blue Ridge and valley provinces (Kelly and Larson 1954; Larson n.d.; Hally 1987). In addition, the Cumberland Plateau and Blue Ridge provinces are within a day's walk. It is apparent that the placement was equally advantageous for the elite resources found at the site.

The Hopewell site is very different, as it does not appear to have been a place of habitation for large numbers of people. Prufer (1964) suggests that the site was sparsely occupied and acted as a focus for ceremonials and mortuary rituals. He further suggests that smaller habitation sites were located in advantageous ecological zones outside the actual precincts of the Hopewell site. Population for the area would have been large, but dispersed. The placement of these smaller sites are thought to have focused on subsistence concerns rather than the acquisition of elite materials. Nevertheless, some of the elite materials, such as Flint Ridge flint, Ohio pipestone

and cannel coal, are available in the area of the Ohio drainage (Seeman 1979).

A number of the exotic materials found at one or the other of the two sites are derived from similar geologic formations or from similar biotic communities. This simplified acquisition for the native collectors. These teamed materials are pearls and mother-of-pearl; marble, mica, chalcedony, and quartz; copper and copper carbonate. The other elite materials were, for the most part, available in separate deposits nearby. Specific analytic data on sources of the material found at the sites have yet to be adequately compiled; however, general areas can be suggested based on historic documentation and the analyses which have been done.

Alligator teeth and shark's teeth could have come from the same general area as the marine shell. Alligators have a very broad range making it difficult to pinpoint a specific locality; however, a general locality of the Southeast is certain. Two alligator teeth were recovered from the Hopewell site, and none were found at Etowah. Similarly, sharks are available along most coastal areas. Nevertheless, it is suggested that the shark teeth found at the Hopewell site probably came from the few Florida sites which have been identified as being Hopewellian (Seeman 1979; Milanich and Fairbanks 1980). The Etowah site shark teeth may have been acquired from the Gulf coast. The Lake

Jackson site near Tallahassee, Florida, has a very large cache of shark teeth representing several different species. The site also has copper artifact forms, some of which are identical to those recovered from the Etowah site. This possible relationship will be discussed further in chapter five.

Grizzly bear claws and canine teeth may have come from three locations. The first is the area of Yellowstone Park, the second is Minnesota, and the third is Wisconsin (Prufer 1964:75; Stoltman 1973:111). These last two locations are moot. Bear canine teeth were subjected to a complex adornment procedure that included splitting, pegging, and inlaying with pearls and stones. As with the chalcedony this appears to have been primarily a Hopewell artifact. The Etowah site does not contain actual bear claws or teeth; however, there are effigy rattles made to resemble bear canines. These rattles are fashioned from wood, hollowed out and filled with quartz sand or crushed granules, and clad in thin copper sheet. It is not possible to determine if these effigies filled an analogous role to the earlier artifacts within their respective societies.

Seeman (1979:300-301) points out that there is an overlap in canine size between grizzly bears and their more common cousins, the black bear. Because of this situation he chose to refer to all bear canines found within Hopewell contexts as black bear canines. The effect of this decision

is to remove the material from the list of those goods requiring extensive exchange networks for acquisition. Black bears were common to the eastern United States and are still so in some localities.

Mother-of-pearl and pearls can be problematic for source studies. Nacer producing shellfish are found both in salt and freshwater. Shellfish identification relies on the survival of morphological features of the shell. Cultural modification or deposition may alter the shell enough to make identification impossible. Even under the best of circumstances, interpretive difficulties arise from the loss of shellfish beds through historic pollution and environmental factors. Nevertheless, several researchers have applied themselves to the questions of source and seasonality with encouraging results (Classen personal communication, 1987).

Pearls are more difficult to deal with than shell. No in depth study has ever been done to accurately differentiate between naturally occurring fresh and saltwater pearls (Dickinson 1968; Bauer 1969; Liddicoat 1981). The assumption of origin for pearls found in archaeological contexts at inland sites is based on several historical incidents, none of which are sufficient for the routine identification of inland pearls as freshwater pearls.

The great "Pearlrush" of the mid-1800s is rightfully credited with establishing the pervading myth of the richness of the freshwater pearl beds in North America (Dickinson 1968:119-131). A large pearl was discovered in Notch Brook near Paterson, New Jersey. This find resulted in a 50 year rush for riches, most of which never materialized. Practically every accessible river in the continental United States was explored in search of pearls. The novelty of the freshwater pearl ensured that the market price was artificially high. Unscrupulous entrepreneurs lured individuals, and in some cases whole towns, to buy into "pearl" ventures of dubious merit. Dime novelists fired by chauvinistic leanings wrote glowing reports of the quantity and quality of New World pearls versus those of the Old World. In most cases these novelists described pearls they had never seen. Individual scientists who should have known better were swept up in the fever. G.F. Kunz, a curator at the American Museum of Natural History, became the champion of the freshwater pearl. His co-authored work, The Book of the Pearl (Kunz and Stevenson 1908), became a classic and is still a standard reference for folklore today. It is not surprising that Warren K. Moorehead sought Kunz's opinion concerning the pearls found at the Hopewell site (Moorehead 1922). Kunz based his response on the popular myth, the fact that there were some pearl producing mussels in the area, and a lack of understanding for the

extent of aboriginal trade. Kunz's identification of the pearls as being freshwater was erroneous, but very much in keeping with the times.

Other reputable researchers of the time were not exempt to the exaggerations concerning freshwater pearls. The eminent natural scientist and gemologist Max Bauer (1969 [orig. 1869]) explained the formation of pearls, their common sources, and the accepted rates of occurrence for freshwater and saltwater forms. He noted the scarcity of freshwater pearls in every other region of the world, and claimed without support or verification their abundance in the United States. It is interesting to note that the quantities of freshwater pearls recorded for the 50 years of the Pearlrush (garnered from mussel beds coast to coast) might not account for all the pearls known from just a few of our larger archaeological sites (cf. Hopewell Site, Etowah Mound Site, Moundville, Spiro, and Lake Jackson). In some cases (e.g., Hopewell Site, Etowah Mound Site), the entire known production of pearls, based on verified reports of collecting from freshwater sources, does not approach the quantity of pearls from these archaeological sites. This is not to suggest that freshwater pearls were not used. It is much more likely that the pearls found at inland sites are a combination of freshwater and saltwater species. The Spanish accounts refer to both types of pearl being

collected by the native Americans (Fontaneda 1945; Driver 1961; Smith 1968).

At the present time it is not possible to state unequivocally the source for these materials at either site. Seeman (1979:302) suggests that the pearls found at the Hopewell site are from the local area, based on information provided by the commission of fisheries that suggest their local abundance (Smith 1914, 1916). Unfortunately, he has settled for a dollar amount rather than an actual pearl count. The pearl market during and after the First World War was inflated (Dickinson 1968). Dollar amounts do not reflect abundance, but rather market trends.

Artifacts made from saltwater shell are found at both sites. The majority of these shells belong to either Busycon sp. and Cassis sp. Seeman (1979:299) suggests that these materials most likely came from the Florida peninsula. Goad (1978) concurs with this idea and suggests that prehistorically the eastern United States could be thought of as being divided between two spheres of exchange, a copper exchange network in the northern half and a marine shell exchange network in the southern half; however, these distinctions become practically nonexistent by the Late Woodland.

Chalcedony is a particular form of fine grained quartz. The form found at the Hopewell site has been identified as coming from the Knife River region of North

Dakota (Seeman 1979; Carlson 1979). It has been suggested that the same exchange network or acquisition expedition which collected the obsidian and grizzly bear canines and claws also collected this material (Griffin 1983:265). Chalcedony is not found at the Etowah site.

Cannel coal is a tough bituminous coal used extensively in historic times for the production of an inferior quality of faux jet ornament (Sinkankis 1959:603-605). Objects made from cannel coal are not uncommon in prehistoric or proto-historic contexts. They occur as a fairly common artifact class at some central Ohio sites (Seeman 1979). The high luster, tough material was easily worked using carving techniques similar to those used to produce wood, stone, and shell artifacts. Seeman (1979:296) suggests that the material continues to be of importance during the Mississippian time period, and if anything increases in importance. This is not supported by the archaeological evidence from the Etowah site where cannel coal was readily available, yet only one cannel coal artifact is known from the site.

Bituminous coal is available in Georgia 50 to 100 miles from the Etowah Mound site (McCallie 1926). The mountain range that includes Lookout, Sand, and Pigeon Mountains located in Walker, Dade, and Chattooga Counties has extensive deposits (McCallie 1926:35). A major outcrop

of coal is located at Round Mountain, a centrally defined feature of Lookout Mountain (McCallie 1926:38).

Cannel coal is available throughout much of the Ohio Valley, making it a local resource for the Hopewell (Seeman 1979). Additional outcrops are found in West Virginia, and in the drainages of the Ohio River and the White River near the towns of Cannelton and Washington, Indiana.

Marble is a metamorphic re-crystallized limestone. This material appears not to have been used at the Hopewell site. The only marble in Georgia is in a deposit 3 miles wide by 60 miles long running southwest in an transverse strip from Fannin County and through Gilmer, Pickens, and ending in Cherokee county (McCallie 1926:95). The manufacture of marble statues appears to have been the only use for marble at the Etowah site. A number of marble statues have been recovered from the Etowah site and from the smaller surrounding sites (Moorehead 1932:12, 14, 75; Larson 1954:20).

Mica is a monoclinic crystal of silica compounds (often with alkalis, hydrogen, iron, and manganese) that demonstrates easy cleavage along one axis and great flexibility (depending on actual composition). Muscovite is the form of mica found at both the Hopewell site and the Etowah site. Muscovite is transparent, flexible and colorless. Mica sheet is a common occurrence in the marble beds of Georgia (McCallie 1926:96). The closest beds of

mica to the Hopewell site are located in North Carolina. Aboriginal mining operations have been found in the counties of Mitchell, Macon and Yancey (Holmes 1919:241-52; Sterrett 1923:28). Ornamental use of mica in the form of geometric or effigy cutouts is a common feature at both sites. Several large "books" of raw mica were deposited in Mounds 17 and 25 at the Hopewell site. It seems likely that mica artifact manufacture was occurring on site.

Obsidian is a volcanic glass. As a glass, its amorphous structure allows for incredible flexibility in the hands of an expert flint knapper. Over one hundred finely crafted ceremonial bifaces were recovered from deposits in Mound 25 at the Hopewell site (Moorehead 1922), and a grave in Mound 17 at the same site yielded several hundred pounds of obsidian (Shetrone 1926). The largest ceremonial spear point made from obsidian measured 33 cm in length. The Hopewell site is the only site that has produced significant amounts of obsidian in both raw and finished forms. Obsidian artifact manufacture was accomplished at the site. Griffin (1983) suggests that the obsidian could have been gathered during a single expedition. His constituent analysis of the obsidian has laid to rest Prufer's (1964) and Bell's (1959) contention that some of the obsidian might be from the southwest or Mexico rather than from the Rockies and Yellowstone Park (Griffin, Gordus, and Wright 1969). Obsidian was not found at the Etowah site.

Quartz is a silica oxide and was collected in the form of crystals at both sites. Seeman (1979:298) suggests that quartz in crystalline form was available throughout the Appalachians although the vicinity near Hot Springs, Arkansas, is usually considered to be the source for the majority of crystals at the site. The Etowah site quartz probably came from the same locations as the marble and granitic schists.

Greenstone is a metamorphic slate rock. The stone's relative softness combined with a tough structure makes it suitable material for the manufacture of a variety of elite "tool" forms. These forms include celts, spuds (a thin ovoid shaped artifact), and axes. A major deposit is directly across from the site on the other side of the Etowah River (Larson personal communication). Prufer (1964:75) suggests the lower Allegheny region as the source of this material at the Hopewell site.

Hornstone chert (Wyandotte flint) is found at the Hopewell site and was probably gathered from sources in Indiana or southern Illinois (Streuver and Houart 1972; Carlson 1979). It was not used at the Etowah site.

Steatite is a form of impure talc that is very soft when first quarried, but hardens over time. Common impurities found in steatite are chlorite, actinolite. anthophyllite, magnetite, and pyrite. The steatite deposits closest to the Etowah site are located in Georgia. Several

deposits of steatite are found at Chatsworth in Murray County and Holly Springs in Cherokee County. Primary use of steatite at the Etowah Mound site was to make stone palettes that probably were used for mixing pigments. The Hopewell site materials also came from the southeast. Western North Carolina, the areas already mentioned for northern Georgia, and eastern Alabama are all likely sources (Shetrone and Greenman 1931; Morgan 1952; Seeman 1979).

Graphite is a naturally occurring carbon mineral. Several sources of the graphite found at the Hopewell site have been suggested, such as the Appalachian mountains or the Black Prairie region of Texas (Seeman 1979:298). Given a number of factors, such as accessibility and evidence of aboriginal mining, Seeman suggests that the graphite was probably obtained from the southern Appalachians. The situation is a little clearer for the graphite recovered from the Etowah site.

Graphite can be found in Georgia both as a flake and as a semi-globular mass (McCallie 1926:73). The form is a result of its deposition in associated granite gneiss or metamorphic slates and schists. Bartow, Cobb, and Pickens counties in Georgia all have major deposits of graphite. The closest accessible deposit is interbedded with slates and schists in the city of Emerson, Georgia, less than 10 miles southwest of the site (McCallie 1926:74). Graphite was used as a pigment at the site. Large quantities of

graphite with abraded edges have been found interred with soapstone palettes in association with red ochre and kaolin clay. The carbon (one of several pigments) found on the famous marble statues from the site was probably derived from graphite.

Kaolin clays are found throughout Georgia in the coastal plain, crystalline area, and paleozoic deposits (McCallie 1926:28). Bartow County coincides with a paleozoic deposit. A major deposit of kaolin clay is located at Rome, Georgia, 23 miles from the site (McCallie 1926:30). Nevertheless, thin lenses of kaolin clay can be seen eroding from the bank of the Etowah River adjacent to the site itself (Larson personal communication). The elite usage of kaolin at the Etowah Mound site was as a pigment, either alone or mixed with other minerals. Kaolin does not appear to have been used at the Hopewell site.

Red ochre is a naturally occurring mineral of iron oxide (limonite or siterite). A major commercial deposit is located 2 miles from the Etowah site in downtown Cartersville (Waters personal communication). The use of red ochre as a pigment is of great antiquity throughout the eastern United States. At the Etowah site red ochre is found with other pigments in association with soapstone palettes. Dobyns has recently suggested that red ochre's natural antiseptic action may have been recognized in antiquity. He further suggests that ochre lumps in burials

may be the remains of "medicines" (Dobyns personal communication, 1986).

Galena is a crystal sulfide form of lead. It is easily recognized by its heavy weight, metallic luster, and perfect cuboidal cleavage. Walthall (1979:249) identified the source of the Ohio Hopewell galena as having come from the Upper Mississippi Valley. The galena deposit that is the source for the Etowah Mound site materials has yet to be determined. Galena is not found in Georgia thus requiring trade from other points. Walthall (1981) has provided a synthesis of the trade in galena from the Archaic through the Proto-historic. Based on his description, the galena forms found at the Etowah Mound site were probably traded in from southeastern Missouri (Walthall 1981:27-33). At the present time however, this can only be regarded as a guess. Trace element analysis of the galena from the Etowah Mound site is being planned for the future, which should provide a more definite answer.

Meteoric iron is found at the Hopewell both in the form of raw pieces and as finished artifacts (e.g., celts and chisels). The primary source of the iron is from a meteor located near Newton, Kansas (Seeman 1979; Carlson 1979). Iron artifacts are not common, but invariably elicit comment. No iron was recovered from the Etowah site.

Silver was acquired from the same Great Lakes deposits that provided the copper for the Hopewell site and

from Cobalt region of northern Ontario (Goad 1978; Seeman 1979; Spence, Finlayson, and Pihl 1979). Native silver in size and quality for direct working is not common, which aids in the identification of the sources. The Hopewell site has silver both in worked and unworked forms. Silver seems to have been used primarily as a sheathing material. Copper artifacts have been recovered that have an incredibly thin covering of silver. Unfortunately, the majority of the silver described by Willoughby at the Peabody Museum did not make it to the Field Museum collection.

Native copper was used at both sites. The majority of copper used at the Hopewell site was obtained from deposits in Michigan or from glacial float deposits (Prufer 1964; Goad 1978; Carlson 1979; Seeman 1979). Nevertheless, a small number of the artifacts recovered from the site may have been made with southeastern copper (Seeman 1979:292). Copper is available in Georgia in sufficient quantity for the needs of the early metalworkers; however, the reefs are not as extensive as those found in the Midwest. This situation led earlier researchers to postulate that all the copper artifacts from the pre-European period came originally from the Midwestern sources, although other deposits were known to exist (Moorehead 1932:46-47; Goad 1978:48). This has since been disproved but the actual extent of the utilization of copper taken from these other sources has yet to be adequately quantified. Goad argues

that a shift in copper source occurred over time, from midwestern to southeastern sources (Goad 1978:212-218). She sees this shift in procurement as starting during the Middle Woodland and ending with an almost complete shift to the Appalachian sources by the Late Woodland.

The largest deposit of copper in the Southeast is in the tri-state area of Georgia, Kentucky, and Tennessee. The Ducktown deposit of Tennessee extends into Georgia through the counties of Fannin, Cherokee, and Haralson (McCallie 1926:42). Hurst and Larson selectively tested several copper artifacts from the Etowah Mound site using spectrographic analysis and determined that the copper was most likely from the Fannin deposit (Hurst and Larson 1958). Based on this analysis and Goad's documented shift in copper source, it is suggested that a majority of the copper found at the Etowah site was procured from deposits 20 to 60 miles distant.

Copper carbonate is a natural outcome of oxidation and weathering of exposed copper (Patterson 1971). Procurement of the material could take place either at the source of the native copper or through manufacture (controlled corrosion) at the site. The use of copper carbonate at the Etowah Mound site seems to have been as a pigment mixed with kaolin clay. There does not seem to have been an intentional use of this material at the Hopewell site.

It is quite clear that copper was only one of several materials being used in elite context. It is interesting to note the materials that were found at both sites/periods and those that are unique to one site/period. Many of the materials have been in use by various groups from the Archaic period. The next chapter discusses copper manufacturing techniques used by the native Americans during the Archaic period based on the analysis of the three metal collections.

CHAPTER THREE
ARCHAIC COPPER ARTIFACT FABRICATION

Sites And Samples

This chapter examines the fabrication processes used to make copper artifacts during the Late Archaic time period (3,000 B.C. to 1,000 B.C). The artifacts studied are from the Old Copper Industries collection curated at the Field Museum of Natural History, Chicago. The data generated by this study are combined with the results of previous analyses of the artifacts to produce new interpretations. These interpretations are presented separately for each artifact type. Individual descriptions are followed by an overview of the metalwork of the Old Copper complex.

The earliest copper work in either North or South America was made by the Old Copper Industries of the Great Lakes region, circa 3,000 B.C. (Quimby 1960; Griffin 1983). The abundance of complex copper artifacts by these and other later groups has been a strong stimulus for research (Wilson and Sayre 1935; Frank 1951; Miles 1951; Quimby 1960, 1963; Griffin 1961; Wertime 1964; Easby 1966; Smith 1968; Schroeder and Ruhl 1968; Patterson 1971; Fraikor et al., 1971; Vernon 1985). Except for a very few studies (c.f.,

Miles 1951; Quimby 1960; Griffin 1961; Binford 1962), the majority of the analyses of Archaic copper have been relatively narrow. They often are confined to either a check list approach oriented towards identifying processes, or to a geographic format showing concentrations. Rarely has any real attempt been made to integrate the derived analytical data with the archaeological culture to which it belongs. This is neither surprising nor wholly the fault of the researchers who have attempted to deal with early metal technology in the eastern United States. Our interpretations of early North American Indian social level do not lend themselves to complex metalworking. Metalworking, except in extremely simple forms, has been considered a mark of "advanced" social groups. This idea is of great antiquity and wide currency (Heizer 1962). The problem is that our synthetic definition of the societies belonging to the Archaic period tends to stress overall simplicity, while the Archaic copper artifacts produced by these groups are anything but simple. Archaic copper artifacts are functional and demonstrate understanding of the more difficult manual techniques of metalworking. It should be kept in mind that basic fabrication techniques (that are primarily comprised by, but not limited to, the manual techniques evidenced by the Archaic metal workers) are still difficult techniques for modern metal workers to master, despite our advanced society. In terms of modern

material science these manual techniques are "simple," but, this is a relative term that can often be misleading.

The majority of the analyses of Archaic copper have been performed by material scientists. These analyses are valuable but tend to reflect the interests of material scientists rather than anthropologists. It is the responsibility of the anthropological researcher to make sense of the derived data, a sometimes difficult task.

Miles (1951) in her archaeological and material analysis of Archaic copper materials catalogued both the varieties of copper artifacts and their geographic extent, identifying a minimum of twenty-one different types of copper artifacts (Miles 1951:245). Separation of artifact types was based on a combination of functional and stylistic attributes. Wisconsin was the only region investigated that had all twenty-one forms represented. Based on this, Miles believes that the Lake Michigan-Lake Superior region was the geographic center of a special complex where the use of copper achieved an early development. She states that this complex did not constitute a single society, but rather the output of several societies with shared resource and environmental constraints. Her viewpoint has wide acceptance among archaeologists (Quimby 1960; Griffin 1961, 1983; Wertime 1964; Easby 1966; Vernon 1985). All of the Archaic copper artifacts analyzed in this study are from the Lake Michigan-Lake Superior region analyzed by Miles.

Artifact Descriptions

This study analyzed one hundred and eighty-five Archaic copper artifacts. Artifact types in the Field Museum Old Copper Industries metal collection include native copper nuggets, copper bars, piercing implements, spear points, celts, knives, chisels, and rolled copper beads. Spear points represent the largest single component of the Field Museum's Archaic Old Copper Industries collection. A discussion of each of these artifact types follows.

Copper Nuggets

Three nuggets of native copper were available for analysis. The nuggets were of good size, 23.0 cm X 18.2 cm X 3.8 cm, 8.7 cm X 7.7 cm X 1.5 cm, and 7.6 cm X 4.5 cm X 1.8 cm respectively. Two of the three were copper float nuggets from Wisconsin. The largest nugget had been taken from a modern mine operation in the nineteenth century. None of the nuggets had been recovered with other artifacts, and they represented isolated finds from areas that had produced Archaic copper artifacts. Porosities, which apparently occurred naturally during the nuggets' formation, could be seen in the interior of the two float copper nuggets xeroradiographically. Neiburger (1984) had described similar porosities in the interior of a copper point and crescent from the Milwaukee Public Museum (MPM#s: 56430/22174, 11816/1571). He suggested that these porosities were the result of casting. Based on a series of

replication experiments by this author (Leader 1985), it was suggested that puddle consolidation might be a more likely explanation. Subsequent data derived from analysis of native copper float nuggets now suggest that the porosities are a naturally occurring phenomenon.

Copper Bars

Three copper bars were available for study in the collection (Appendix D, figure 1). The definition of a bar is a square or rectangular rod of copper that lacks pointed ends. In our sample, bars range in length from 8.5 cm to 27.6 cm, a width of 1.0 cm to 1.7 cm, and a thickness of 0.8 cm to 0.9 cm. In all cases the bars are made from solid copper that was hammered, annealed, and ground to shape. The bars were left in a work hardened condition. Stress lines, tension cracks, and exfoliation can be seen in each bar. The bars do not exhibit signs of use. It is possible that the bars are blanks for the manufacture of awls or other piercing implements. Nevertheless, substantial modification of the bars in both length and thickness would be required before a finished artifact would be made.

Piercing Implements

The next largest category of materials is comprised of piercing implements. Miles (1951) suggests that piercing implements are the most common Archaic copper artifacts. She is likely to be correct, although it is not the case of the Field Museum collection studied in this analysis.

Twenty-eight piercing implements analyzed (Appendix D, figure 2) ranged in size from a length of 10.1 cm to 19.7 cm, a width of 0.4 cm to 2.5 cm, and a thickness of 0.3 cm to 0.9 cm. Pins, awls, and other piercing implements are included in this category. This generic grouping reflects the fact that it is still possible to determine that the majority of the pieces possessed at least one pointed end, but it is not often possible to determine if the wear is localized at one end or extends the length of the artifact. Corrosion and overzealous cleaning have in many cases partially or completely obliterated wear patterns necessary to distinguish between closely related artifacts (e.g., pins and awls). Therefore, these artifacts are discussed in this study as a single group. A few artifacts do provide sufficient information about use and will be discussed separately.

The piercing implements were made in very similar ways. Solid copper was hammered into a square, or more rarely, rectangular, rod. Annealing did occur during the initial stages of shaping but was not used as a final step. In most cases the implements are bi-tapered with two functional ground points.

Fifteen of the piercing implements analyzed in this study came from a single cache discovered during the building of the ship canal at Sault Ste. Marie, Michigan. Most of these tools show definite signs of use. Two of them

(FMNH#s: 52185, 52192) were clearly resharpened at both ends. At least two other implements from this cache were used as fasteners (FMNH#s: 52180, 52181). One end of both implements was purposefully bent during antiquity to provide a "stop." One implement in particular (FMNH# 52207) had an end hammered into a flattened fan shape. The center of the artifact shows wear and the pointed end has been resharpened. Another copper hook from the Old Copper Industries collection (FMNH# 68058) was found in a different area of the construction of the Lake Superior ship canal. It has a flattened end, a tip that has been intentionally bent back upon itself, and was probably also used as a fastener.

Some of the other artifacts contained in the cache are problematic. Two of the implements (FMNH#s: 52188, 52190) are identical in cross-section and bent in a gentle arc to form a crescent. It seems likely that these artifacts may also be fasteners of some form. Unfortunately, corrosion masks the wear patterns. Another implement (FMNH# 52186) has an unusual cross-section that closely resembles the shape of a piece of a quartered pie. Overzealous cleaning has left unmistakable marks from a wire brush on this unique artifact and removed any useful information.

Vernon (1985:158) analyzed the Archaic copper collection at the University of Pittsburgh and discovered that two of the seven awls had been made from rolled and

compacted sheet. The only provenience information for the rolled awls is that they were found in Green Lake County, Wisconsin, which makes it difficult to determine an accurate age. Vernon's analysis of the rolled awls' manufacturing technique is interesting since it suggests the tools were made from scrap materials. Copper sheet scrap is usually considered to be characteristic of the Woodland and Mississippian time periods, not the Archaic. Of equal interest are Vernon's (1985:161) conclusions about the hardness of the seven awls he tested. All but two were left in a work hardened state. The two awls that were not work hardened are one of the two rolled forms and a "deeply corroded awl." Neither of these two artifacts can be considered to be representative of Archaic copper awls under normal conditions.

Socketed Spear Points

Socketed spear points are one of four types of copper spear points analyzed in this study. They are more frequent then the other types of points, including tanged spear points, notched spear points, and rolled cone spear points. A socketed spear point is defined as a two edged lanceolate or triangular shaped blade with a base in the form of a three sided open socket. Fifty-two socketed spear points were analyzed. They range in size from 6.1 cm to 23.5 cm in length, 1.3 cm to 3.9 cm in width, and 0.2 cm to 0.6 cm in thickness. The socket depth ranged from 0.5 cm to

1.2 cm. There are two variations of socketed spear point represented in the collection. The first is a spear point that has a blade with a triangular cross-section (Appendix D, figure 3), and the second has a blade resembling a flattened oval in cross-section (Appendix D, figure 4).

Manufacturing processes were similar for both types (Appendix D, figure 5). A copper nugget or laminar plate of sufficient size was hammered, annealed, and ground into a roughly triangular shape. In the case of the spear points with a triangular cross-section, the central rib was formed by hammering and then refined by grinding. On the other hand, the flattened oval form of spear point appears to have had the cutting edge angles ground in after the formation of the socket. The sockets in both cases are identical. One side of the triangular copper sheet was chosen as the base. Straight fold lines were carefully hammered into the sheet parallel to each other and perpendicular to the base. The copper corners on either side of the hammered lines were ground off to form parallel edges with the hammered lines. The metal was then very carefully folded along the hammered lines to form the open socket. Shoulders were formed at the junction of the socket top and cutting edge base by hammering the socket folds over and inward at that point. When the hammered metal fold was flush with the surface of the spear point, excess material in the newly created shoulders was ground away. The result is a three-sided

socket, relatively wide at the base and narrowed at the top. A snug fit was easily obtained for the spear shaft by adjusting the width of the socket through mild hammering or burnishing.

Smith (1968) suggests that the regularity of the sockets is indicative of the use of a mandrel or form. The regularity of manufacture and sharpness of angles found in every socketed spear analyzed, regardless of type or size, does lend credence to Smith's suggestion. Nevertheless, this is not a clear point. It is possible to produce straight and consistent bending angles without a form or mandrel and if the attached shafts were of similar size (shaft size being an ergonomic function), then the sockets would also be highly uniform.

All but one (FMNH# 68107) of the socketed spear points with a flattened oval cross-section have holes biconically drilled just interior of the basal edge of the socket. Wear in these holes suggests that they were used to pin the spear points to their shafts. In several cases (FMNH#s: 52041, 68013, 68028, 68112, 68149, 168160) the original drill hole became worn and resulted in a small channel leading through to the basal edge. In one case (FMNH# 168179), the hole became an oblong that could no longer hold the pin. Another hole was drilled just above the first hole, but, in time this hole also became worn and eventually merged with the first hole. The pattern of wear

for all these spear points suggests that a thrusting and pulling motion was responsible for the change in hole shape.

One of the triangular cross-section socketed spear points (FMNH# 68179) had a drill hole but did not show a wear pattern similar to the oval cross-section socketed spear points. Rather, the wear patterns and damage from use evidenced by this spear point and the other triangular cross-section spear points was quite different. The most noticeable alteration was in the form of a bend line. Several of the spear points (FMNH#s: 52033, 52065, 52071, 52073, 52146, 68018) had suffered bent tips that had been re-straightened in antiquity. In at least one case (FMNH# 52065), the bend occurred several times and resulted in a wire edge effect and loss of the tip. The term wire edge refers to a thinning, compression, and subsequent failure of metal caused by bending. Anyone who has ever twisted a coat hanger back and forth until it breaks has seen the effect. A similar bend also appears in several spear points at the top of the socket (FMNH#s: 52033, 52161, 68046).

A socketed copper spear point with triangular cross-section was made and tested in an effort to reproduce the observed wear patterns. The copper spearhead was hafted using wood dowel and hand thrown ten times against a soft surface (archery target), and ten times against a variety of hard surfaces (e.g., trees and rocks). Hand throwing of the hafted spear point resulted in bends when the spear point

struck an unyielding surface head on at a slight angle. An atlatl was made from wood and the series of ten throws was repeated. Atlatl assisted throws resulted in a greater number, and severity, of bends than did unassisted throws. The reason is the greater force given to the spear by the spear thrower. When the spear was thrown against a yielding surface (archery target) by an atlatl no bends resulted. Penetration of the archery target was significantly greater when the atlatl was used.

Edge chips, and at least one case of resharpening to lessen the damage done by a chip (FMNH# 68018), can also be seen in the triangular cross-section socketed spear points. It seems likely that these spear points were used primarily as projectile points, based on the wear patterns, damage, and lack of a drilled peg hole in all but one case. The triangular cross-section socketed spear point was very functional, as long as the hunter struck the target.

Prior analyses have pointed out that the majority of both types of socketed spear point were finished in an annealed state (Schroeder and Ruhl 1968; Smith 1968; Vernon 1985). This led a number of researchers (Binford 1962; Vernon 1985) to question whether these artifacts were utilitarian tools. They argued that only work hardened or inadvertent case hardening would result in a copper tool hard enough to be functional. Xeroradiographic analysis of the socketed spear points analyzed in this study shows a

dense structure, but without the stress lines, cracks, or folds normally associated with copper left in a work hardened state. Clearly the copper spear points are not in a hardened state, does this make them less functional?

In a cultural system, metal hardness is only desirable when it is perceived by the user to be desirable. The "givens" of any technology are only perceived as such when they fulfill a recognized need of that society. The underlying concept is one that is often difficult for non-social scientists to grasp. The idea of the universality of technological truths is unfortunately a myth. The assumption has been that metal hardness is necessary to offset the undesirable consequences of a copper tool's use (dulling and bending). On the face of it, this concern is well founded. A triangular cross-section socketed spear point when hand thrown or atlatl assisted potentially receives a tremendous amount of localized force against its thinnest section, the point. Work hardening is a commonly suggested solution and would stiffen the point. Unfortunately, a work hardened native copper spear point, depending on degree of hardening, is likely to split or break on heavy contact with an unyielding surface. An annealed copper spear point does not split or break as readily and can be easily bent back to shape after a mishap. The softness of the copper actually prolongs the usefulness of the tool.

It seems likely that the triangular cross-section of the spear points is not ornamental or the result of use, but the intentional formation of a stiffening rib. A stiffening rib is a reasonable solution to the slight loss of piercing capabilities caused by a softer copper spear point of narrow design.

Tanged Spear Points

Tanged spear points are defined as bifacial double edged lanceolate or triangular shaped copper blades having either flat or oval tangs (Appendix D, figure 6). Twenty-seven tanged spear points were analyzed. They ranged in length from 5.8 cm to 15.6 cm, in width from 1.0 cm to 4.2 cm, and thickness from 0.2 cm to 0.5 cm. Similar manufacturing processes were used to make these artifacts. A copper nugget or laminar plate of sufficient size was hammered into a fairly uniform plate. The plate was then hammered and ground to shape. Annealing of the plate was done throughout the process as needed. The cutting edges were compacted and thinned by cold working and in some cases left in a hardened state (FMNH#s: 52016, 68011, 68084, 68138, 68142; xeroradiography analysis, and Schroeder and Ruhl 1968). The hardened state would suggest to most researchers that the artifacts might have been used. Unfortunately, very little in the way of use related markings are still extant on these pieces. Corrosion of the artifacts while in the ground coupled with later overzealous

cleaning have taken their toll. Nonetheless, a few points may still be deduced. Bent and re-straightened tips (FMNH#s: 52044, 68020) and "stepped" edge chips (FMNH#s: 52016, 68138) suggest that at least some of these spear points were being used as thrusting weapons and perhaps as projectile points. The wide flat tangs of these spear points coupled with a work hardened state would reduce the amount of warpage resulting from a hard thrust.

Notched Spear Points

Notched spear points are quite interesting. They are invariably made from very flat sheet and closely resemble a silhouette of a lithic point (Appendix D, figure 7). Four of these points were available for analysis. They range from a length of 5.1 cm to 12.5 cm, a width of 1.5 cm to 4.4 cm, and a thickness of 0.2 cm to 0.3 cm. None of these points show any sign of use, although one spear point (FMNH# 52223) does show evidence of hafting. Three of these points appear to be effigy forms. Copper effigies of projectile points are well known from later time periods, but not from the Archaic. The shapes of two of the effigy points (FMNH#s: 52223, 68012) correspond to several possible Woodland forms from western Michigan (c.f., Fitting 1975). This raises the possibility that some of the surface finds attributed to the Archaic Old Copper Industries are actually of a somewhat later date. Schroeder and Ruhl (1968) experienced a similar difficulty. Since the catalog

includes these materials as being a part of the Archaic copper collection, the identification, with reservations, will be allowed to stand.

Rolled cone spear points

Rolled cone spear points are probably the simplest form of point made during this time period (Appendix D, figure 8). Six were available for analysis from the collection. They range in size from a length of 4.5 cm to 11.5 cm, a width of 1.7 cm to 2.7 cm, and a metal thickness of 0.3 cm to 0.7 cm. The points were invariably made from hammered sheet that was not fully annealed. The sheet was then modified to resemble an oblique triangle, which was wrapped around a mandrel to form a cone with an abutted seam. The time and care so apparent in the making of the other spear points is lacking in these. One rolled cone spear point (FMNH# 68112) has a drill hole opposite the seam and close to the basal edge of the socket. This hole has been worn into an ovoid shape that intersects the basal edge of the piece. The wear is similar to some of the flattened oval cross-section socketed points. Xeroradiography suggests that the point was left in a hardened condition. Numerous tension cracks on the surface of the artifact support this conclusion. Schroeder and Ruhl (1968) analyzed this point using stereology and suggest that the tip was left in a hardened condition, but that the socket was annealed. Unfortunately, the cuts necessary for the

stereology have obliterated any use marks from the tip. Nonetheless, this point seems to have been used as a thrusting weapon based on the pattern of wear in the peg hole. The other two rolled cone points have similar xeroradiographic signatures to the first one but show no evidence of use.

Copper Celts

Celts are defined as rectangular tools with the unifacial cutting edge located on one of the shorter sides. Twenty-two celts were available for study. They ranged in size from a length of 7.3 cm to 30.0 cm, a width of 2.0 cm to 10.5 cm, and a thickness of 0.3 cm to 1.8 cm. The celts were made primarily from native copper nuggets although laminar plate may have been used for some of the smaller forms. Hammering and annealing were both used during the forming of the copper to the desired shape. Binford (1962) suggests that some of the axes and celts were made by hammering together individual leaves of material, a form of "cold welding." No such technique was observed during the analysis of this collection. After the initial forming, the artifact was given an overall polish and a sharpened cutting edge by grinding.

The celts can be divided into two types based on shape. These types are (in frequency of occurrence) square edge celts and socketed celts.

Square edged celts

Square edged celts are the most familiar form to most researchers (Appendix D, figure 9). The cutting edge is straight and forms an approximate right angle with either side. None of the square edged celts show hafting marks; however, almost all of them show use. The wear patterns and use damage on these pieces is intriguing. The poll end (end opposite the cutting or bit end) of several of these tools (FMNH#s: 52170, 52172, 52175) shows definite signs of upending (Appendix D, figure 10). Upending is a blacksmithing term that refers to the "mushroom" effect resulting from hammering against the end of a rod with a hard hammer. The bit ends of these tools show chipping, folding, stress cracks, and resharpening. It seems likely that these tools were not hafted but were hand held. The tool's cut was accomplished through transmitted force from a blow administered to the poll end. Schroeder and Ruhl (1968) analyzed two of the square edged celts included in this study. They found that both of the celts (FMNH#s: 52168, 52233) had been heavily cold worked (Schroeder and Ruhl 1968:163) and left in a hardened condition. One of the celts (FMNH# 52168) is referred to as a wedge. It seems likely that they also noticed the upending of the poll edge, although they do not mention it. All the square edged celts are very dense xeroradiographically and show signs of internal stress and slippage, surface cracks are very common

as are areas of exfoliation. It is suggested that all the square edged celts in this study are in a work hardened condition.

Seven of the celts were from the previously mentioned Sault Ste. Marie cache. No socketed celts were found in the cache.

Socketed celts

The socketed celts are listed in the Museum catalog as being axes; however, the cutting edge is unifacial and perpendicular to the haft. Since the form is more closely akin to an adze or celt then to an axe they are identified as such in this study. Five socketed celts were available for study (Appendix D, figure 11; Appendix E, figure 1). They range in size from a length of 2.9 cm to 13.5 cm, a width of 2.1 cm to 10.5 cm, and a metal thickness of 0.3 cm to 1.1 cm.

The socketed celts and socketed spear points are very similar in technique of manufacture. Laminar plate or nuggets were hammered, annealed, and ground until they resembled a truncated triangle. The relatively narrow truncated edge becomes the cutting edge. As with the socketed spear points, two joint lines are hammered into the sheet perpendicular to the basal edge and relatively close to the corners. The corners are ground off on a line parallel to the joint lines. The metal is bent along the joint lines forming a three-sided open socket. Slight

shoulders are formed by bending the socket edge inward at a point farthest from the basal socket opening. Excess material is ground away after the socket wall is bent flush with the body of the celt to form a shoulder similar to the socketed spear points. The result is a socket with a wide opening, generous interior, and narrowed top that acts as a stop.

One of the socketed celts has been given an incorrect catalog number (FMNH# 52174). This is unfortunate, since the artifact is incompletely finished and clearly demonstrates the manner of manufacture. Most of the socketed celts show some very slight edge wear, even though they have been thoroughly cleaned. This allows for the identification of these artifacts as being functional, but does not shed as much light as would be desirable. A few additional points are apparent. The weight of these artifacts is very high in relation to the size of the cutting edge (c.f., FMNH#s: 68077 - 240.9 grams, 68079 - 119.9 grams) Additional force through the ingenious method of hafting would make these tools very efficient choppers.

Knives

Knives are defined as unifacial or bifacial single edged flat implements with elongated forms (rectilinear or crescentric) having the cutting edge on a long side. Fifteen copper knives were available for analyses. They range in size from a length of 8.6 cm to 20.0 cm, a width of

1.5 cm to 3.0 cm, and a thickness of 0.2 cm to 0.5 cm. All but two of the knives were made from flat sheet. The exceptions are socketed knives (FMNH# 52123, 68002), which will be discussed a little further on. Two of the flat knives (FMNH#2: 68003, 168191) are tentatively identified as ulus based on the crescentric shape of the blades. Unfortunately, they are both in a very fragmentary state making an absolute identification difficult.

Flat knives

The flat knives were made by hammering either nuggets or laminar plate into flat sheet that was ground to a uniform thickness (Appendix D, figure 12). Annealing was used during this process but the knives have been left in a hardened condition. The final shape was formed in many instances by a combination of overall grinding and hammer packing of the edge. Hammer packing is a blacksmithing term that refers to localized hammering to increase metal density. Hammer packed knife edges tend to hold a better edge. Two of the knives (FMNH#s: 52259, 52115) were analyzed by Schroeder and Ruhl (1968:164). They found that both of the knives demonstrated extensive cold working. Schroeder and Ruhl's analysis discerned the difference in hardness between the edge and interior of one of the knives (FMNH# 52259), a clear indicator of a hammer packed edge, but they were apparently unaware of the significance.

Surface corrosion has removed any use or wear patterns from the majority of the knives. Nevertheless, two of the flat knives show signs of use, a twisted tip that has been straightened in antiquity (FMNH# 52260), and edge chipping (FMNH# 168186).

Socketed knives

The process of manufacture for the socketed knives is similar to the manner in which the socketed spear points and celts were made (Appendix D, plate 13). A copper nugget or laminar plate of sufficient size was hammered, annealed, and ground into a roughly triangular shape. As with the flattened oval form of spear point, the cutting edge was ground in after the formation of the socket. The knife socket and the other sockets are identical. One side of the triangular copper sheet was chosen to form a base. Straight fold lines were carefully hammered into the sheet parallel to each other and perpendicular to the base. The corners of the copper triangular sheet on either side of the hammered lines were ground off to form parallel edges with the hammered lines. The metal was then very carefully folded along the hammered lines to form the open socket. Shoulders were formed at the junction of the socket top and cutting edge base by hammering the socket folds over and inward at that point. When the hammered metal fold was flush with the surface of the spear point, excess material in the newly created shoulders was ground away. The result is a three-

sided socket, relatively wide at the base and narrowed at the top.

The sockets of these knives are quite interesting. The socket on one knife apparently was never used for hafting. Instead, the opening at the base has been closed off by bending the edge upward until it meets the socket sides (FMNH# 68022). This does result in an effective handle but is a curious use of time and material. The socket of the other knife is open and has a small biconically drilled peg hole. No wear is visible in the peg hole which suggests that this knife may have started out to be a socketed spear point and was later modified. In both cases the blade is in the form of a right triangle with the cutting edge located on the hypotenuse. A substantial part of the knife tip from one of the knives is gone (FMNH# 68022), apparently twisted off in antiquity. The other knife shows a series of old bend lines at the tip, and edge chips are evident for both. Actions such as prying and splitting of materials would most likely account for this damage. A substantial haft (formed by the socket) would be useful to insure efficiency and comfort during these actions.

Chisels

Chisels tend to be strongly tapered in form with their widest point occurring at the cutting edge (Appendix D, figure 14). They varied in size from a length of 13.3 cm

to 17.0 cm, a width of 2.0 cm to 3.0 cm, and a thickness of 0.3 cm to 0.9 cm. The poll end of some of these chisels closely approximates a rounded point (FMNH#s: 52167, 52171, 52175, 68061). The cutting edge of all but two of the chisels is dissimilar to the square edge celt. The chisel edges develop into a strong curve half way across the edge. The curved cutting edge totally removes what would be a "corner" on the square edged celt. The portion of the edge that retains its approximate right angle merges into a squared edge. The rounded portion becomes knife like by the time it intersects the side. The exceptions (FMNH# 52296, 68061) are square in cross-section, and have a cutting edge that is gently crescentric.

There were nine chisels available for study. Edge chips and resharpening are evident on at least a few of these chisels (FMNH#s: 52171, 52202, 68061). No evidence remains of hafting or end percussion. The chisels' relatively small size, tapered form, rounded edge, and wear patterns suggest that they were hand held and used for shaving or graving. As with the square edged celts, internal markings coupled with exterior tension cracks and areas of exfoliation suggest a work hardened state.

Beads

A startling departure from the functional tools that comprise the majority of any Archaic copper artifact list is the very common rolled copper beads. Ten rolled beads were

available for study. They range in length from 1.8 cm to 0.7 cm, in width from 0.4 cm to 0.2 cm. Their thicknesses of less than 0.05 cm define the materials as foil. In each case, very thin unannealed copper sheet was rolled around a round form or mandrel (Appendix D, figure 15). Each bead clearly shows the effects of yield point stress. This phenomenon can be identified as an abrupt bend (or "corner") in the surface of a sheet that has been bent into a circle or tube. Fully annealed copper easily conforms to the desired shape (dependant on thickness) while hardened sheet resists until the exerted force overcomes it.

Beads are not functional at the base level of a society, what Binford (1962) refers to as the technomic level. Rather, they were used as simple adornment and perhaps as a sign of some form of status or role. There is insufficient information concerning the societies of the Late Archaic to properly assess the use of beads. Nevertheless, by the Middle Woodland beads are clearly being used for both adornment and as symbols of status.

Fakes

Several Archaic copper artifacts from the Field Museum are not what they seem. Schroeder and Ruhl (1968) determined that a copper axe (FMNH# 52230) had been cast from non-native copper closely approximating European materials. During the course of the present analysis another artifact, a socketed spear point (FMNH# 68080), was

determined to be a fake. This artifact had been hammered very poorly from copper sheet without annealing, and the socket had been made in the shape of two rectangular tabs. The very poor construction techniques coupled with a socket structure unlike any of the other socketed artifacts aroused suspicion. Chemical analysis showed the piece had a high concentration of lead consistent with modern commercial copper production.

The brisk trade in Indian antiquities during the middle and late nineteenth century (which continues unabated to the present) spawned a number of dealers of dubious reputation who were not above deliberate fabrication and dissemination of forgeries. Forgeries have been found in most museums and will undoubtedly continue to be found during collection analyses. It is unfortunate that Neiburger did not supplement his useful xeroradiographic analysis with simple chemical tests.

Summary

In summation, the Archaic copper artifacts analyzed have demonstrated several points. The majority of the tool forms made in copper are functional. That is to say that it can be determined that knives were used as knives, spears as spears, and piercing implements as piercing implements. Suggestions that the artifacts were primarily intended as socio- or ideo-technic forms are oversimplifications. That is not to say that the use of some of the artifacts did not

include social categories subsumed under these jargonistic terms. It does suggest that there is no easy way to separate the two.

The technical proficiency of the Archaic artisans is advanced. None of the artifacts produced in copper are simple. While some are considerably more complex than others (c.f., socketed spear point vs. rolled cone point), they all demonstrate an intimate awareness of basic fabrication techniques. These techniques include cold working, hot forging, annealing, grinding, and rolling tube beads over mandrels. Some artifacts represent ingenious solutions to basic engineering problems (c.f., triangular cross-section socketed spear points), while others may represent solutions to problems that we can only dimly perceive (c.f., socketed knife, crescentric pins). Nonetheless, these artifacts represent a robust application of experience with direct applications.

Knowledge of working copper and the tools themselves were apparently widespread. Numerous tool forms of closely similar manufacture are found throughout the Great Lakes region, often several hundreds of miles apart. Goad's (1978) discussion of Archaic exchange, or Quimby's (1960) discussion of transhumance could account for the dispersal of similar forms.

The lack of both workshops and good chronological data makes any statement concerning popularity over time,

tool evolution, and possible long term storage difficult. Potentially enlightening information exists in the form of artifact caches which have yet to be fully reported.

A number of the artifacts that were analyzed in this study came from a cache located near Sault Ste. Marie, Michigan. Caches are interesting because they represent ordered behavior. In some cases this behavior can give valuable insight into the operation of at least a segment of a social group. The cache from Sault Ste. Marie contained numerous piercing implements and celts, at least one tool blank, a knife, and several unused/unsharpened tools. No exhausted or worn out tools were included, nor were any spear points included. The piercing implements vary as to over all length, but are remarkably consistent in width and thickness. Nine of the fifteen implements fall within 0.2 cm of each other (3= 0.4 cm x 0.4; 3= 0.6 cm x 0.5 cm; 3= 0.6 cm x 0.6 cm). Although this range is an acceptable variance for hand wrought rod and the effects of corrosion, it is more likely that three separate rods were split into at least three pieces each to make these tools.

Five of the six chisels with single curved cutting ends are also from this cache. As with the piercing implements, the chisels also demonstrate a high coherency. The very close sizes, similar cross-sections and overall finish of these tools suggest that the implements were made

by a single individual, possibly the person who interred them.

Regardless of whether or not the same person who made the artifacts interred them, there are some additional points that can be made. All of the tools included in the cache are functionally designed for producing or modifying artifacts. The majority of these tools had been used and were still in a condition for continued use. These tools can be referred to as sedentary tools, in that they are more likely to be used at a camp or resting place than while on the move. No non-sedentary tools (spear points, harpoons, darts) are included in the cache. No burial or other materials were associated with this cache. Given this information it seems likely that the cache represents some form of processing tool kit.

Copper is heavy, and the tool forms included in the cache relatively bulky. It is logical to believe that individuals belonging to a hunting and gathering society would temporarily leave larger items behind when engaged in activities (centrally located) that did not rely on the larger items. After completion of these other activities, the individuals would return and reclaim their belongings from the cache. The lack of hunting artifacts is interesting, since isolated finds have been found in the

general area in which the cache was found. It is possible that the cache represents a rest stop or camp for an individual or individuals who were not able to reclaim their belongings.

CHAPTER FOUR
MIDDLE WOODLAND COPPER ARTIFACT FABRICATION

Introduction

This chapter examines the technology used to make copper artifacts during the Middle Woodland time period (200 B.C. to A.D. 400). The artifacts studied are from the Hopewell site collection which is curated at the Field Museum of Natural History, Chicago. The data generated by this study are combined with the results of prior analyses of the artifacts to produce new interpretations. These interpretations are presented separately for each artifact type, and are followed by an overview.

The basic technique used to make the sheet ornaments recovered from the site was first suggested by Frank Cushing in 1894. Cushing's interest was the result of a paper given by Moorehead at a meeting of the Anthropological Society of Washington in 1892. Cushing had studied the historic Zuni techniques for making thin silver and copper plates and was interested in Indian metal technology. He volunteered to study the Ohio Hopewell artifacts to determine the techniques of manufacture. Cushing did not know that the

Zuni techniques he had studied were actually of historic Mexican derivation (Lund 1976:30), a fact which obscures the relevance of some of his interpretations. Nonetheless, his basic analysis of the sheet ornaments and geometric cut-outs is accurate.

Cushing suggests that the copper was hammered on a flat surface until the overall size was achieved (Appendix D, figure 24). Frequent annealing would be necessary to keep the larger copper sheets from cracking or splitting during manufacture. When the coarse sheet had reached the desired size and thickness it was ground using stone abraders (e.g., sandstone, limestone). The grinding ensured a uniform surface and thickness. At this point the metal was ready for the design. Cushing believed that a parfleche silhouette was used to facilitate the tracing of the design on the metal. A wooden tool (probably crutch-like) with a bone or antler tip was used to indent the surface while following the edge of the template. Application of this pressure shaper to first one side and then the other, would result in the characteristic raised and lowered relief central to the sheet ornaments. Detachment of the plaque from the extraneous copper border would be facilitated by the indenting of a border line around the piece. This border was then worn away with an abrader. The wear through of the border line would be on a perpendicular plane to the

surface, resulting in a squared edge effect after smoothing (burnishing).

Cushing's suggestion for the use of a parfleche (or other flexible material) template is based on the remarkable symmetry of the thin copper sheet artifacts, and the historic use of parfleche silhouettes by the plains Indians. The symmetry of the artifacts is striking. A flexible material such as parfleche (beaten skin) could be bent in half during shaping resulting in bifold symmetry. Once a template has been made, it is relatively easy to transfer the design to a copper sheet. Cushing recognized that a half-image template was also a viable technique. The design would only need to be reversed on the metal to achieve the same result. No templates have been found at the Hopewell site. Nonetheless, several of the artifacts were probably made using templates and will be discussed in greater detail in their respective sections.

Artifact Descriptions

This study analyzed nine hundred and forty Middle Woodland copper artifacts from the Hopewell site, Ohio. Metal artifact types from the Hopewell site include metal blank and nuggets, axes, celts, chisels, bracelets, brooches, beads, buttons, earspools, breastplates, copper strips, panpipes, effigy sheets, cut-outs, and headdresses. This order corresponds with the increasing complexity of

fabrication techniques used to make these artifacts, and will be followed in the discussion below.

Blanks and Nuggets

Metal blanks and nuggets are the raw material from which the majority of the metal artifacts are made. They can be defined as pristine or partially modified native metal nuggets or laminar plate (Appendix D, figure 16, 17). Twenty-four nuggets and blanks were available for testing. They range in size from a length of 12.8 cm to 6.3 cm, a width of 10.5 cm to 3.0 cm, and a thickness of 3.4 cm to 0.5 cm. The blanks tend to be somewhat square in shape and show evidence of being hammered and ground. This square shape is not directly tied to any one artifact type. Therefore, the reason for the blanks being modified in this way is not known. Nevertheless, some speculations are possible. Native copper nuggets often contain porosities and pieces of matrix. One way to determine th quality of a nugget is to subject it to hammering. Poor quality nuggets tend to split when struck or differentially compress, depending on the form and number of the interior contaminants. The metalworkers who made the artifacts discussed in the following pages were very competent. It is possible that the uniform shape of the blanks is partially the result of material testing. It is not farfetched to suggest that they were involved in a rudimentary form of quality control.

Another explanation for the shape of the blanks relates to transport and ultimate use. Native copper nuggets regardless of deposition (primary/mined, secondary/float/alluvial) tend to be of random sizes and shapes. Copper is not exactly a light weight resource. A standardized shape allows for easier transport and sorting. The ability to estimate the number of a specific artifact type that could be made from a specific blank might have been desirable. The shape and size of the blank probably determined the overall size of several artifacts (e.g., axes, celts, and chisels). A discussion of this point occurs in the sections dealing with the descriptions of these artifacts.

The relationship between nugget/blank size and artifact size continues through the Mississippian time period. Careful planning was a feature of the manufacturing techniques that resulted in the production of the thin copper sheet ornaments from the Etowah and Lake Jackson sites. It will be demonstrated in the following sections that advanced planning was central to the manufacture of the Hopewell artifacts as well. The metal artifacts from the Hopewell site are in some respects more complex than than those which have been recovered from earlier or later time periods.

Two of the blanks were made from meteoric iron, which is chemically different from other iron ores (FMNH#s:

56306, 56325; Moorehead 1922:110, 128-129; Carr and Sears 1985). It is interesting to note that the blank that has been the least corroded (FMNH# 56306) closely resembles the majority of the copper blanks. Meteoric fragments are rarely found in a smooth rectangular shape. The decision to modify this piece to the familiar shape of the more common copper blanks is interesting, as it lends credence to the possibility of a standardized metal blank shape. Iron artifact types found at this site include celts, chisels, a headdress, earspool overlays, a panpipe, a button, a drill and rolled beads (Carr and Sears 1985:80). The same technology was used to make the artifact types regardless of whether they were made of iron or copper. Celts and chisels account for the greatest total weight of iron at the site, although rolled beads account for the greatest number of iron artifacts.

Copper Axes

Axes are defined as rectangular tools with a bifacial cutting edge located at one of the shorter sides (Appendix D, figure 18). Four copper axes were available and they range in size from a length of 63.0 cm to 20.4 cm, a width of 12.8 cm to 9.6 cm, and a thickness of 4.4 cm to 0.9 cm. The axes were all made from single pieces of copper. Grinding, hammering, and annealing were the techniques used to manufacture these artifacts. Grinding, rather than hammering, was the primary technique of choice

for the majority of axes. Deformation of natural porosities show that hammering was used, but not to a great extent.

The largest axe recovered from the site (FMNH# 56297) was subjected to an additional analytical technique, tomography. A scan of the artifact was made from three directions to minimize distortion and to ensure full coverage (Appendix E, figure 2). The analysis determined that the axe had been made from a single nugget of copper. The finished weight of the axe is 12,814 grams. The original nugget was heavier, although it is not possible to be sure of the exact starting weight. A number of the internal porosities were identified and sampled for density. The porosities represented actual voids. Modification of the voids by hammering was seen in some, but not all cases. Modified voids occurred in areas where the axe had been thinned and widened. This suggests that the thinning and widening of the metal was by hammering rather than grinding. The size and finish of the artifact made detection of the hammering invisible prior to the xeroradiographic analysis. The extreme size of the axe was thought to be a factor in the choice of metalworking techniques. Although, another smaller axe (FMNH# 56043) was subjected to tomographic analysis with an identical result. Grinding is a time consuming activity. The decision to shape axes by this technique is interesting and represents a departure from the

copper axe manufacture during earlier and later time periods.

The finished axes appear to have been left in a slightly hardened state. The few tension cracks and internal stress lines observed in these pieces support a slightly hardened state. Nevertheless, the lack of edge exfoliation or heavy deformation suggests that the artifacts were never over-worked. Grinding the artifacts to shape would not harden the metal and probably accounts for the lack of unequivocal indications of hardening. Individual variations in overall size and treatment of the axes are probably tied to the initial size of the copper nuggets or blanks. Grinding is a stock removal technique that ensures that the final product is always smaller than the initial blank. The axes do not appear to have been standardized in size or weight, nor do they show any signs of use.

Copper Celts

Celts are defined as rectangular tools with an unifacial cutting edge located on one of the shorter sides (Appendix D, figure 19). Forty celts were analyzed, they range in size from a length of 20.5 cm to 5.5 cm, a width of 9.6 cm to 3.2 cm, and a thickness of 1.4 cm to 0.5 cm. The celts were made from native copper nuggets of laminar plate. Grinding, hammering, and annealing were the techniques used to form the copper to the desired shape and size. After the initial forming, the artifacts was given an overall polish

and a sharpened cutting edge. None of the celts show signs of hafting or use. Schroeder and Ruhl (1968) analyzed two celts (FMNH#s: 56276, 56285) included in this study. Schroeder and Ruhl (1968) concluded that the artifacts' structures were modified by cremation making it difficult or impossible to determine anything. These celts were recovered from burial #260,261, which was an extended burial not a cremation.

Xeroradiographically, the celts show a dense undifferentiated structure. Few celts show any signs of exfoliation, tension cracks, slippages, or porosity deformations. This blandness of structure suggests that the celts were being made from uniform materials, or that they have been grossly affected by heat. Grinding as a primary technique would not affect the internal structure. The celts' internal density and lack of porosities would then be a natural phenomenon. This is possible, but unlikely for the majority of the celts. It is much more likely that the celts were "packed" by hammering during manufacture and then softened by heat. It is not possible at the present time to delineate between the two.

Two celts in the collection are made of meteoric iron (FMNH#s: 56268, 56270). The dimensions of these artifacts are 11.0 cm x 6.0 cm x 1.3 cm, and 9.7 cm x 5.3 cm x 0.9 cm. Both celts were carefully made and are similar in form and manufacturing technique to their copper

counterparts. Corrosion and subsequent cleaning have removed any signs of possible hafting or use.

Iron Chisels

Two of the four iron chisels recovered from the Hopewell site were available for study. The dimensions of these chisels are 2.7 cm x 1.3 cm x 1.0 cm, and 4.5 cm x 1.4 cm x 1.2 cm. Manufacture of these pieces was probably accomplished by grinding of small iron fragments to shape. The corrosion on both celts was cleaned making it impossible to determine use. Some material adhering to the poll ends of both chisels may be remains of hafting. If this is the case, then the chisels were inset into wood or antler in a similar fashion as a socketed celt.

Solid Copper Bracelets

Several copper bracelets were recovered from the Hopewell site. For purposes of discussion the bracelets can be separated into two different types, solid and hollow (Appendix E, figure 3). The techniques of manufacture are discussed separately below. Solid copper bracelets are lengths of copper rod that have been bent in a circular shape. Six solid bracelets were available for study. They range in length from 9.2 cm to 7.4 cm, in width from 8.8 cm to 6.7 cm, and in thickness from 1.0 cm to 0.6 cm. The technique of manufacture is straight-forward and does not depart from the methods already discussed for the axes and celts. A copper nugget or laminar plate is stretched into a

long rod by hammering and annealing. Rod can also be formed from a thick square strip of copper sawn or chiseled off of a thick copper plate. The cross-section of the rod tends to be a round edged square. After the metal has been hammered to the desired shape and length, it is carefully ground to remove any sharp edges. The rod is then bent around a cylindrical mandrel (e.g., a smoothed tree branch) until the ends abut. Annealing is important to the successful manufacture of the artifact. No yield point stress structures are present which suggests that the artifacts were softened by annealing prior to final shaping.

Hollow Bracelets

Hollow bracelets closely resemble the solid rod bracelets, but represent a significant departure in manufacturing technique (Appendix E, figure 4). Ten hollow bracelets were available for study. The bracelets range in length from 10.2 cm to 9.0 cm, in width from 9.8 cm to 7.7 cm, in thickness from 2.1 cm to 0.5 cm, and in metal thickness from 0.3 cm to 0.1 cm. Copper nuggets or laminar plate were hammered and annealed until a thin plate of copper was produced (Appendix D, figure 20). The surface of the plate was ground to a uniform thickness by stone abraders, and a rectangular strip was detached from the copper plate. The strips were somewhat uniform in length (ranging from 21.9 cm to 22.9 cm), although they varied in width. The fully annealed copper strip was hammered down

the center while resting inside a hemispherical depression (probably a carved piece of wood). The rounded surface on which the strip was hammered ensured that the strip would form a wide "U" in cross-section, and that it would bend into a circular shape. Clear hammer marks are visible on the inside sections of the bracelets. The wide "U" cross-section was further refined by laying the circular bracelet on its side and gently hammering the flaring edges inward. This changed the wide "U" cross-section to a parallel sided "U" cross-section. Areas of mild over-hammering resulted in a slightly rippled effect in the inward edges of the bracelet. It is not possible to form the "U" cross-section in a circular band bracelet without the use of a hemispherically depressed form. The very similar appearance of these bracelets, coupled with their roughly similar lengths, and metal thicknesses, suggests that they may have been the product of a single workshop. No wooden forms suitable for making the bracelets have been recovered from the Hopewell site.

Copper Brooches

The copper brooches are deceptively simple and resemble a truncated cone in shape (Appendix E, figure 5). Five brooches were available for study. They range in length from 12.0 cm to 9.5 cm, and in width from 11.5 cm to 9.4 cm. They all share a metal thickness closely approximating 0.1 cm. A copper nugget or laminar plate was

hammered and annealed until the desired size and thickness was reached (Appendix D, figure 21). The surfaces of the sheet were abraded with a stone abrader to remove any inconsistencies. Two circular lines were raised in the sheet. One circle was smaller and fit inside of the larger circle resulting in a doughnut-like shape. The interior circle of some of the brooches (FMNH#s: 56151, 56152, 56153) had two rectangular tabs opposite each other that extend into the center hole. These tabs had punched holes in their centers through which a pin (perhaps of bone, wood, or metal) went to secure the brooch. Brooches that lacked central tabs (FMNH#s: 56154, 56155) had punched holes opposite each other just inside the rim of the inner circle. These holes served the same function as the holes in the tabs. To form the brooch the flat doughnut shaped copper sheet was placed in a hemispherical cavity (probably carved wood) and beaten down. The technique of beating metal into a form is called sinking. Sinking the metal into the form resulted in the three-dimensional truncated cone shape of the artifacts.

A form gauge was used to measure the wall angles of the brooches. The majority, but not all, of the angles were similar for each artifact. Slippage during sinking, warpage from use or deposition, and damage from cleaning or improper curation can alter the shape of thin copper artifacts. It was gratifying that the artifacts in the Field Museum

collection were so well preserved. The close similarities between these pieces suggests that the same form was probably being used for all of them. Since the pieces apparently were made using the same form, and were found in a pile, one atop the other (Moorehead 1922), it is possible that they represent the production of a single workshop.

The brooches and hollow copper bracelets are the only artifacts recovered from the site that demonstrate the use of a form. It is interesting to note that the basic shape of the forms used at the site to produce both artifact types are the same. Unfortunately, there is at present insufficient information to determine if they are the same form. This technique has not been identified as being present in the Archaic time period, but it was used in the later Mississippian period. Several eagle dishes recovered from the Lake Jackson site, Florida, made use of this technique.

Copper Rolled Tube Beads

Metal beads can be separated into two types for purposes of discussion. These types are rolled tube beads and metal clad stone beads. The most common form of bead at the site, regardless of metal, is the rolled tube bead.

The Hopewell copper rolled tube bead is identical to the rolled tube beads of the Archaic and Mississippian time periods. Two hundred and forty-five copper rolled tube beads were studied. They range in length from 2.9 cm to 0.3

cm, in width from 0.6 cm to 0.1 cm, and have an approximate thickness less than 0.05 cm. The copper rolled tube beads were formed by rolling very thin copper sheet around a cylindrical form or mandrel (Appendix D. figure 15). Each copper rolled tube bead clearly shows the effects of yield point stress. This phenomenon can be identified as an abrupt bend (or "corner") in the surface of a sheet that has been bent into a circle or tube. Fully annealed copper easily conforms to the desired shape (dependant on thickness), where as hardened sheet resists until the exerted force overcomes it. Storage and reuse of earlier copper rolled tube beads would be difficult to detect. Nevertheless, it is unlikely that the beads were intentionally stored for reuse due to the thinness of the metal and their susceptibility to corrosion and wear, a factor which may skew the archaeological record.

Corrosion of these beads is advanced in all cases. A table recording each bead's measurement is not provided in Appendix B, since these measurements give little insight into the original condition.

Copper Clad Stone Beads

Copper clad stone beads represent a departure from earlier bead manufacturing methods (Appendix E, figure 6). Four large copper clad stone beads were available for study. They vary in size from a length of 8.7 cm to 3.9 cm, a width of 6.6 cm to 3.8 cm, and a thickness of 2.6 cm to 2.2 cm. A

sandstone core was ground to shape and biconically drilled for a suspension hole. The majority of these stone cores are round, although one (FMNH# 56039) is roughly cruciform in shape. Cross-sections for the beads tend to be elliptical. The stone core was clad with two pieces of hammered and annealed copper foil. The foil overlapped the edge formed by the elliptical cross-section. Holes were punched into the copper foil to allow access to the biconically drilled holes in the stone core.

The manufacture of copper clad stone beads requires careful planning and execution. The steps outlined above are fairly time consuming and laborious. Nevertheless, there are several distinct advantages to the technique. Copper scrap left over from the manufacture of other artifacts could be used for the relatively small beads, and would stretch the amount of useful copper collected by the metalworkers. In addition, sandstone is considerably easier to shape and drill than solid copper and the finished artifact weighed a fraction of a comparable solid copper bead. If comfort was a factor, a necklace of copper clad stone beads would be more comfortable than a similar necklace of solid copper beads. Although it can not be said with certainty that the metalworkers who made these beads were concerned with these specific points, it seems likely that at least a few of them were probably taken into account.

Silver Clad Stone Beads

Two silver beads were analyzed in this study. Both beads are similar to the copper clad stone beads described above. The dimensions of the beads are 4.0 cm x 3.8 cm x 1.1 cm, and 1.7 cm x 1.6 cm x 1.1 cm. The manufacturing technique does not differ from the copper clad stone beads. A sandstone core was ground to shape and biconically drilled for a suspension hole. The cross-sections of the two beads are elliptical. The stone core was clad with two pieces of silver foil. The foil overlapped the edge formed by the elliptical cross-section. Holes were punched into the silver foil to allow access to the biconically drilled holes in the stone core. The same advantages outlined for the copper clad stone beads obtain for the silver clad stone beads.

Iron Rolled Tube Beads

Iron rolled tube beads account for the largest number of iron artifacts at the Hopewell site. Two hundred and fifty iron rolled tube beads were analyzed. They are similar to the copper rolled tube beads. The iron rolled tube beads range in size from a length of 1.8 cm to 0.5 cm, and a width of 1.1 cm to 0.3 cm. The metal thickness of the beads can not be determined due to corrosion and fragmentation. Individual bead measurements will not be given in Appendix B. Heavy corrosion has taken place on all the beads. Thus measurements can not be related to original

size. The range measurements are provided as a general statement and should be viewed with caution. The manufacturing technique is the same as the one used to produce the copper rolled tube beads. Yield point stress structures are clearly visible on the iron rolled tube beads.

Copper Buttons

Copper buttons are defined as round copper clad sandstone beads that are attached through two holes on the bottom of the artifact. The buttons are very similar to the copper clad stone beads except for the manner of attachment (appendix D, figure 22). Seventy-three copper buttons were available for study. The buttons range in size from a length of 2.3 cm to 0.9 cm, a width of 2.2 cm to 0.9 cm, and a thickness of 1.0 cm to 0.5 cm. The thickness of the metal used to clad these artifacts is less than 0.05 cm. A sandstone core was ground to a hemispherical shape. The flat bottom of the button had an oval channel ground into it stretching from just inside the edge and across the center of the stone. The prepared stone core was clad with two pieces of copper foil. The foil overlapped the edge formed by the hemispherical cross-section. Two holes were punched into the copper foil covering the bottom of the button to allow access to the channel ground into the stone core. Twine was threaded through the holes for attachment (White 1987). The ground channel was deepened in the center to

form a slight crescent making threading the button easier to accomplish. Several hundred buttons were recovered from the site (Moorehead 1922), although only a fraction remain.

Ellanor White analyzed the textiles recovered from the Hopewell site and identified a number of extant buttonholes (1987). Moorehead (1922:80) recovered a number of buttons at the Hopewell site from the rib area of skeletons. It seems likely that these artifacts are indeed buttons. White (1987:27) points out that buttons have not been reported for earlier or later groups. A possible functional reason for this is that the buttons are not very strong. All the stress of closure and material weight was focused on an area of unsupported metal foil that seldom exceeded 0.4 cm in length and 0.2 cm in width. Metal failure probably occurred frequently. This suggests that the Hopewell site buttons were not subjected to frequent stress, and might have functioned primarily as ornaments.

Copper Earspools

Moorehead (1922) estimated that over four thousand earspools were recovered from the Hopewell site. Unfortunately, the majority of these have been reduced to fragments by corrosion. Seventy-eight earspools were found to be sufficiently intact for an analysis (Appendix D, figure 23). They range in size from a length of 5.6 cm to 2.7 cm, a width of 5.5 cm to 1.4 cm, and a metal thickness of 0.2 cm to 0.1 cm. Overall thickness ranges from 2.5 cm

to 0.1 cm, depending on the completeness of the artifact. The method of manufacture used to make these artifacts is interesting. Copper nugget or laminar plate was hammered and annealed until a sheet of the desired size was made. The surfaces of the sheet were carefully ground smooth and even. Two circular pieces of copper sheet, of equal size, were cut from the sheet, bossed, and joined together by a rivet. The rivet was made from either a rolled tube or a solid rod. The rolled tube rivet is the more common form. Two other matching circular pieces of copper were often bossed and placed on top of the first pieces. These additions were held in place by a folded edge that overlapped the edge of the initial circular plates, or in a few cases, by the central rivet. Spacers resembling a rolled tube bead were often placed around the center rivet to support the sheet circle ends, and perhaps to thicken the center section. Twine was often wrapped around the spacer. Great care was taken by the metalworkers to match the earspool components by size and finish.

Katherine Ruhl is presently completing an in depth comparative analysis of Hopewell earspools. She has suggested that there may be as many as four different styles during this time period (N'omi Greber personal communication 1987). Jefferies (1976) was able to delineate two styles at the Tunacunnhee site located in northwest Georgia. The delineation of style differences can be a touchy thing (Plog

1983). Although, two different earspool "forms" were observed by this analysis it is not suggested that there are two "types" of earspool. Instead, there appears to be a single form of earspool in differing conditions of completeness. The differences were additive, not fundamental. It is not possible to state that there was more than one earspool "type" based on this analysis. Undoubtedly, Ruhl's larger study will clarify this difficult situation.

Copper Breastplates

Copper breastplates are defined as large primarily unadorned rectangular copper sheets with two centrally located perforations. The overall shape and proportions of the breastplates are the same although the size may vary. The shorter sides of the rectangular plate are slightly concave, and in some cases this shortens the top side (Appendix E, figure 7). Twenty-three breastplates were available for study. Breastplates range in size from a length of 31.5 cm to 19.8 cm, a width of 17.1 cm to 11.0 cm, and a thickness of 0.3 cm to 0.1 cm. The technique of manufacture for these artifacts is very straight-forward. A copper nugget or laminar plate was hammered and annealed until a sheet of copper the desired size was produced. The surface of the sheet was ground smooth, and the distinctive outline of the breastplate was embossed into the sheet. The raised outline was ground away freeing the breastplate from

the surrounding extraneous copper. Two suspension holes were either punched or biconically drilled into the sheet. It is impossible to determine the use of these plates due to the loss of information caused by corrosion and subsequent cleaning although some of the plates were recovered from the chest region of burials. None of the breastplates show signs of wear or repair.

One of the breastplates appears unique (FMNH# 56337) however, it has been heavily reconstructed and its present form may not be accurate. It has a pendent lobe hanging from the corners of one of the longer sides. The measurements for this artifact are 33.0 cm x 13.5 cm x 0.6 cm. The extreme thickness is a result of the use of plaster of paris to support and consolidate the metal. Poster paints were used to camouflage the plaster of paris which shows through the numerous cracks and lacuna which comprise the plate. The lobes are similar to portions of two other artifacts, elongated oval pendants with hollow semi-rounded cross-sections (FMNH#s: 56224, 56225). If the pendant ends were detached and flattened they would closely approximate the shape of the lobes on the breastplate. Close examination of the central portion of the plate revealed that several fragments overlap. It is possible that this artifact is comprised of fragments from several different artifacts, all of which were found together. If the lobes

were removed the artifact becomes indistinguishable from the other breastplates.

Copper Strips

Copper strips are similar to the copper breastplates, except that they are true rectangles and much narrower. Seven copper strips were available for study. The extant copper strips range in size from a length of 26.3 cm to 10.7 cm, a width of 9.4 cm to 4.9 cm, and a thickness of 0.2 cm to 0.1 cm. Only one of the strips has a thickness of 0.2 cm, all the rest are 0.1 cm. Great care must be taken to not put undue reliance upon metal thickness measurements. It is impossible to be absolutely sure of the original metal thickness due to modification by corrosion and cleaning.

Manufacture of these artifacts is similar to the copper breastplates. A copper nugget or laminar plate was hammered and annealed until a sheet of copper the desired size was produced (Appendix D, figure 24). The surface of the sheet was ground smooth, and the outline of the copper strips embossed into the sheet. The raised outline was ground away freeing the strip from the surrounding metal. Six holes, three to an end, were either punched or biconically drilled through the sheet. It is difficult to determine the use of these plates due to the loss of information caused by corrosion and subsequent cleaning.

One possible use, based on size of the strips, would be as the initial stage in the manufacture of a panpipe.

Panpipes are made from rectangular strips that fall within the parameters of the extant copper strips. Although some strips may have functioned as ornaments in their own right. The six attachment holes may have been intended as a lacing set for the panpipes or as suspension aids. Further discussion of this point follows in the description of the copper panpipes.

Copper Panpipes

Copper panpipes are defined as a series of hollow reeds or bones held in place by a metal strip. There is no proof that the panpipes are musical instruments. The name is based on form rather than demonstrated function. Seven panpipes were available for study. The extant panpipes range in size from a length of 9.1 cm to 6.0 cm, a width of 5.4 cm to 3.4 cm, and a thickness of 2.2 cm to 1.7 cm. The metal thickness ranges from 0.2 cm to 0.1 cm. Unrolled, they range in size from a length of 21.6 cm to 16.8 cm, a width of 5.4 cm to 3.4 cm, and a thickness of 0.2 cm to 0.1 cm. These measurements fall within the parameters of th copper strips described earlier. The widest copper strip (FMNH# 56219) had a width of 9.4 cm. This seemed an excessive width for a panpipe, and it was thought to be a distinct ornament. Nevertheless, a fragment of a panpipe (FMNH# 56223) had an extant width of 9.4 cm, although very

little else. This suggests that even the largest of the copper strips might have been used in the manufacture of the panpipes. Unfortunately, there is still insufficient data to combine the two categories.

Manufacture of the panpipes is very interesting (Appendix D, figure 25). A copper nugget or laminar plate was hammered and annealed until a sheet of the desired size was produced. The surface of the sheet was ground smooth and the outline of the copper strip embossed into the plate. The raised outline was ground away freeing the strip from the surrounding copper. Hollow reeds or bones were laid side by side and bound as a series by folding the copper strip around them. The ends of the copper tend to overlap rather than abut (FMNH#s: 56006, 56115, 56223, 56708). In at least two cases (FMNH#s: 56006, 56117), six holes were either punched or drilled, three to an end, through the copper strip. The function of these holes was probably to ensure a secure closure by lacing with organic materials (e.g., twine, rawhide, or sinew). A burnishing tool was used to press the surface of the copper strip down between the reeds or bone tubes after they were secured by the copper strip resulting in one flat and one ridged side.

Effigy Sheets

Effigy sheets are defined as a thin copper sheet that has natural designs embossed upon it (Appendix E, figure 8). In terms of complexity these artifacts are in

between breastplates and geometric cut-outs. Seven effigy sheets were available for study. They range in size from a length of 40.0 cm to 7.6 cm, a width of 20.0 cm to 5.1 cm, and a thickness of 0.1 cm or less. Manufacture of these artifacts follow several steps. Copper was hammered and annealed until the desired size was achieved. The coarse sheet was ground smooth and the design was embossed into the surface of the sheet. Extraneous copper surrounding the effigy sheet was removed by grinding through the raised border line. A distinctive squared edge results from this technique. Attachment holes were punched through the sheet rather than drilled. It is not possible to determine the use of these sheets due to the loss of information caused by corrosion and subsequent cleaning. None of the copper effigy sheets show signs of repair.

Cushing (1894) believed that the use of a template was necessary for the manufacture of the effigy sheets and the geometric cut-outs. Although his opinion can be supported for the manufacture of a number of the geometric cut-outs (discussed separately), it is not clearly supported for the effigy sheets. Only one group of effigy sheets (FMNH#s: 56192, 56193) demonstrate coherence in size and shape. The other effigy sheets share basic forms within their respective groups, but are not identical. The existence of categories of standardized copper artifacts does not preclude the existence of non-standardized copper

artifacts of equal size and complexity. These artifacts can clearly co-exist at the same site, within the same medium. The implications of this point will be discussed in chapter six.

Some effigy sheets were probably made with a template. Four effigy sheets recovered from the Hopewell site are representations of an animal's paws, probably a bear. Three of the sheets are at the Field Museum and the other is in the possession of the Ohio Historical Society. Two of the sheets at the Field Museum were available for study. Their dimensions are 7.6 cm x 7.5 cm x 0.1 cm, and 7.8 cm x 7.5 cm x 0.1 cm. The 0.2 cm discrepancy in length is a result of damage to the piece. Production of these artifacts followed the techniques already described with one significant exception. The phalanges of the paws and the pads of the paws are bossed, giving a semi-circular cross-section to the artifacts. Extraneous copper sheet between the phalanges of the paws have been removed by abrasion, thus giving an accurate outline of a paw print.

Copper Cut-outs

The copper cut-outs from the Hopewell site are probably the most spectacular representation of North American Indian metalworking skill (Appendix D, figure 26). Sixty-six copper cut-outs were available for study. They range in size from a length of 31.3 cm to 3.1 cm, and a width of 18.3 cm to 2.9 cm. The metal thickness ranges from

0.2 cm to less than 0.05 cm. The method of manufacture used to produce these artifacts is a logical next step from the techniques used to produce the effigy sheets. A copper nugget or laminar plate was hammered and annealed until a desirable sheet of copper was produced. The surfaces of the sheet were carefully ground smooth. A design was then embossed into the surface of the plate. The narrow raised lines which comprised the design were worn through using a stone abrader. Attachment holes were invariably punched through the metal sheet rather than drilled. The major difference in technique between the effigy sheets and the cut-outs is the total removal of all raised lines by abrasion. The result is a design in two dimensions.

Making a cut-out was not a simple thing. The individual manufacture of these artifacts required considerable planning and time. The more complex cut-outs such as the famous serpent head (FMNH# 56165) or the circular geometrics (FMNH#s: 56161, 56162, 56164) required the removal of raised lines forming complex curves, circles, and remarkably symmetrical designs. Removing these lines by abrasion is a painstaking process requiring concentration. An inadvertent slip can result in a gouging of the adjacent metal surface. Circles are particularly bothersome.

A replication experiment was performed using a sheet of annealed copper 0.05 cm thick (Appendix E, figures 10, 11, 12, 13, 14). A simple geometric cut-out design was

embossed using an antler tipped tool. A sandstone abrader was used to remove the raised lines. A common problem was that a minute section of a circle stubbornly adhered. A similar situation also occurred at sharp corners. These sections were invariably small and adjacent to another portion of the design that might be damaged by any slips during abrasion. Removal of the piece by twisting was safer and easier than grinding it away. Nevertheless, twisting the metal off left a distinctive mark at the point of removal. The Hopewell site cut-outs invariably show the remains of a similar action on the interior edges of circular holes in the larger cut-outs (e.g., FMNH#s: 56164, 56165, 56189); and in the corners of several others (e.g., FMNH#s: 56157, 56158, 56178).

A strong coherence was evident in the size and shape of several of the artifacts (FMNH#s: 56157, 56158, 56160; 56161, 56162; 56167, 56168; 56169, 56216; 56178, 56179; 56180, 56181; 56184, 56185; Appendix E, figure 9). This suggests that templates may have been used to ensure similar artifacts. This is not to say that these artifacts are precisely identical, they are not. The technique of manufacture would ensure that there would be minor discrepancies. Several of the designs thought to be symmetrical are actually asymmetrical (FMNH#s: 56161, 56162; 56167, 56168; 56182, 56183; 56184, 56185). It is interesting to note that the asymmetries are the same within

each group. This situation supports the idea of template use.

The "tongue" of the serpent (FMNH# 56206) represents a somewhat different approach on the part of the metalworkers. Four "tongues" (FMNH#s: 56206, 56207, 56209, 56210) are part of the Hopewell site collection curated at the Field Museum of Natural History, Chicago. The widths of the pieces are too different to support the possibility of template use. Yet, the overall shapes and individual internal measurements are too regular to be free-hand manufacture. A possible solution is that the artifacts themselves were used as a template. If each artifact was used as a template for the next artifact (A for B, B for C, C for D), then there would be a significant difference in overall measurement (but not internal consistency) between the first and last artifact made. Unfortunately, this hypothesis can not be tested due to the fragmentary state of the artifacts.

The extant cut-outs were invariably made from a single sheet of copper. All the extant cut-outs show varying amounts of wear around the attachment holes. Nevertheless, only the serpent's head has any signs of repair. A patch (with tube rivets) has been added to the artifact just behind an eye and above an attachment hole. A xeroradiograph of the piece shows that the break is a type usually associated with stress from flexing. This suggests

that the head was firmly attached to a rigid support and moved in a fan-like motion. It seems unlikely that burial furniture would be handled in such a manner or repaired. This artifact, and perhaps the other cut-outs, were a part of the living culture.

Copper Headdresses

A copper headdress is defined as a copper covering specifically for the head. Several headdresses were recovered from the Hopewell site. Three remain in the collection at the Field Museum of Natural History, Chicago. One of the two was on exhibit and not available for close inspection, although it was studied. The two headdresses that were available for analysis have the following dimensions, 30.3 cm x 10.3 cm x 0.8 cm (FMNH# 56364), and 11.4 cm x 10.5 cm x 0.2 cm (FMNH# 56100-1). All the techniques used to make the other artifacts were used to make the headdresses (Appendix D, figure 27). Copper was hammered and annealed until plate of the desired size was produced. A rectangular or slightly oval plate was outlined in the copper by an embossing tool, and detached by grinding. The annealed plate was bent and domed to fit the curvature of the head. The headdress on display and one of the headdresses available for close inspection had an additional feature, antlers. Unfortunately, the only headdress with antlers intact was in the exhibit case.

Nevertheless, inspection of the headdress with antler "nubbins" provided interesting information.

On the "nubbin" headdress the antler support was made by sinking two areas of the headplate into hollowed cylindrical depressions (probably wood). The result was copper "nubs" sticking up from the headplate. The closed ends of the "nubs" were ground open and the antlers fit inside. The antlers were made of carved wood clad with copper foil. The cylindrical antler supports on the available headdress (FMNH# 56100-1) are approximately 4.0 cm x 3.8 cm.

In addition to the damaged condition, the headdress has gone through some drastic reconstruction (Appendix E, figure 15). A wooden support was placed inside the headplate and plaster of paris has been used to consolidate the metal. The plaster of paris is anywhere from 0.4 cm to 0.6 cm thick. Poster paints have been used to camouflage the plaster of paris. Nonetheless, xeroradiographic analysis supports the accuracy of the reconstruction.

Summary

This chapter has examined the technology used to make copper artifacts during the Middle Woodland time period. The artifacts analyzed came from the Hopewell site collection curated at the Field Museum of Natural History, Chicago. Nine hundred and forty artifacts representing fifteen different forms were analyzed and separate

descriptions given for each. The metalwork recovered from the Hopewell site has been referred to as being the finest metalwork done by the North American Indian (Prufer 1964). This may not be an overstatement. The artifacts that were analyzed in this chapter demonstrate that the metalworkers of this period had mastered the basic techniques of hammering, annealing, stretching, embossing, cladding, piercing, riveting, and stock removal. In addition, they made use of forms for sinking metal, templates, mandrels for bending tubes and bracelets, and were fully aware of complex construction techniques for the manufacture of multi-component artifacts. The cut-outs and effigy sheets show an ability to produce startlingly accurate realistic portrayals in three dimensions, and equally competent abstracts expressed in terms of positive and negative space. The sheer quantity of the material suggests that this was an ongoing intimate interaction.

Raw materials, partially modified materials, and possible finished components for the manufacture of specific artifacts have all been recovered from the Hopewell site. It seems likely that the artifacts were being made either on site, or very close to it. The question of metal specialists being at the site is discussed in chapter six.

CHAPTER FIVE
MISSISSIPPIAN COPPER ARTIFACT FABRICATION

Introduction

This chapter examines the technology used to make copper artifacts during the Mississippian time period (A.D. 900 to European contact). The artifacts studied are primarily from the Etowah collection, portions of which are curated at West Georgia College, Carrolton, and at the Etowah Museum in Cartersville. Comparative data were provided by analyses of artifacts from the Lake Jackson site (Florida) and Fort Center site (Florida) collections. The Lake Jackson collection is curated at the Florida History Museum, Tallahassee and the Fort Center collection is curated at the Florida State Museum, Gainesville. The data generated by this study are combined with the results of prior analyses to produce new interpretations for each artifact type. Individual descriptions for each artifact type are followed by an overview.

Copper artifacts of the Mississippian period differ from the forms previously discussed for the earlier time periods. Late Archaic metal artifacts tend to be thicker, heavier, unornamented, and primarily of utilitarian use (Leader 1985; Clark and Purdy 1982; Easby 1966; Quimby 1963,

1961; Driver 1961; Frank 1951; Miles 1951; Wilson and Sayer 1935). Cold hammering, grinding, hot forging, piercing/drilling, rolling, and some riveting are the common techniques for metalwork during the Late Archaic period. Middle Woodland metalwork uses the techniques of the Archaic and adds repousee/chasing, cladding, sinking forms, opus intrasille, rolled tube rivets, templates, and a greater emphasis on (and coherence of) motif/design (Clark and Purdy 1982; Seeman 1979; Fraikor 1971; Patterson 1971; Schroeder and Ruhl 1968; Easby 1966; Binford 1962; Frank 1951; Shetrone 1926; Moorehead 1922; Holmes 1919).

Mississippian metalwork incorporates the techniques of the past with an increased emphasis on artifacts fabricated from thin copper sheet. This emphasis can be clearly seen in the proliferation of artifact types manufactured from thin sheet copper (e.g., raptor/warrior plates, sun symbol plates, open eye symbol plates, four wind symbol plates, and numerous smaller symbol badges) (Leader 1985; Jones 1982; Schnell et al. 1981; Brown 1976; Hamilton et al. 1974; Larson 1971, 1954; Fundaburk and Foreman 1957; Waring and Holder 1945; Moorehead 1932; Cushing 1894). Artifacts which were made from solid copper during the Middle Woodland, such as earspools, are made from wood with a copper sheathing during the Mississippian.

Goad (1978) performed trace element analysis on copper artifacts from various sites in the Southeast

representing the Woodland, and Mississippian time periods. Her analysis suggests that there was a shift in the sources for native copper by the Mississippian time period (Goad 1978:209-210, 212-215). The plentiful, but distant, copper areas of the midwest were replaced by the closer and less fruitful copper outcrops of the tri-state region of Georgia, Tennessee, and Kentucky. The less plentiful supply of copper within the Southeast may have stimulated the use of metalworking techniques which would conserve and extend the resource.

The coherency of design motifs in copper and other materials found in the Southeast during the Mississippian time period led Waring and Holder (1945) to formulate the concept of the Southeastern Ceremonial Complex. Although the exact meaning/importance of this synthetic concept has yet to be agreed upon (Waring and Holder 1945; Krieger 1945; Howard 1968; Muller 1983), the Etowah Mound site exhibits a strong affinity with the motifs of the complex (Waring and Holder 1945).

Artifact Descriptions

This study analyzed two hundred and forty-eight Mississippian copper artifacts. Metal artifact types from the Etowah and Lake Jackson site collections include symbol badges, headdresses, raptor/warrior being plaques, raptor dishes, earspools, rattles, bodkins, gorgets, beads, and

axes. This order corresponds with the technique of fabrication and will be followed in the discussion below.

Symbol Badges

Symbol badges are small sheet copper ornaments fashioned to represent natural forms (e.g., feathers, raptor talons). Additional designs, usually geometric, may be incorporated (e.g., sun signs, four wind/direction symbols). Four different types of symbol badges are found at the Etowah site. Mace symbol badges, feather symbol badges, arrow symbol badges, and raptor talon badges were recovered from burials and are listed here in order of frequency.

Mace symbol badges

The most common symbol badge is the mace symbol badge. Two forms of mace are depicted on the badges, stepped and plain, and are equally represented at the site. The two forms are described separately below.

Stepped mace symbol badges. Stepped mace symbol badges were recovered from both the Etowah and Lake Jackson sites (Appendix D, figure 28). Twenty-six stepped mace symbol badges were available for study. The badges range in length from 7.6 cm to 10.5 cm, and in width from 3.0 cm to 5.7 cm. All the stepped mace symbol badges were fashioned from very thin sheet, 0.05 cm in thickness or less. Accurate measurement of metal thickness is not possible due to corrosion. Stepped mace symbol badge fabrication was deceptively simple. A copper nugget or laminar plate was

hammered and annealed until a sheet of the desired thickness was reached. The sheet was then smoothed by grinding the surface with fine sandstone. A raised border outlining the piece was indented and ground off. The surface design was pushed into the artifact blank by a smooth round tipped tool (such as an antler tip or shaped bone). An attachment/suspension hole was biconically drilled into the piece as a final step. The stepped mace symbol badge appears to have been worn on the chest or as an adornment for feathered headdresses.

One headdress recovered from burial #45 at Etowah suggests an additional technique used in fabricating the stepped mace symbol badges. Many of the stepped mace symbol badges from Etowah burial #45 appear to be identical in size and shape, suggesting the use of templates. Accurate comparison of the symbol badges could not be done since they are sealed within glass and wood frames and could not be accurately measured. A silhouette of the badges was made from clear plastic and laid over the badges inside the sealed frames. A strong coherence was evident in the size and shape of the majority of badges. Better support for the use of templates was uncovered at the Lake Jackson site. Twelve stepped mace symbol badges were recovered from Mound 3 and were available for close inspection. Eight of the twelve stepped mace symbol badges are similar to the silhouette from Etowah, two had been reduced to dust, and

two were in an incomplete state. The strong resemblance of the eight badges to the Etowah silhouette suggests that a template was being used to ensure a standard artifact.

The Lake Jackson materials suggest that standardized artifacts were finding their way to social groups far removed from the original place of manufacture. Minor variations in width and "stepping," noted for some of the stepped mace symbol badges at the Etowah site, are consistent with detachment errors and the nature of the manufacturing techniques.

Plain mace symbol badges. Plain mace symbol badges were only recovered from the Etowah site (Appendix D, figure 29). Nine plain mace symbol badges were available for limited study. The badges range in length from 7.3 cm to 10.4 cm, and in width from 3.3 cm to 3.9 cm. All the plain mace symbol badges were fashioned from very thin sheet, 0.05 cm in thickness or less. Accurate measurement of metal thickness is not possible due to the artifacts being glued to a supporting fabric. The fabrication techniques used to make the plain mace symbol badges is identical to the techniques used to make the stepped symbol badges. A copper nugget or laminar plate was hammered and annealed until a sheet of the desired thickness was reached. The sheet's surface was ground smooth and a raised border outlining the piece was indented and ground off. The surface design was pushed into the blank by a smooth round tipped tool (such as

a bone or antler point). An attachment/suspension hole was biconically drilled into the piece as a final step. The plain mace symbol badges appear to have been worn on the chest or as feathered headdress adornments.

Many of the plain mace symbol badges from Etowah appear to be similar in size and shape. Accurate comparison of the badges could not be done since they are sealed inside of glass and wood frames. A silhouette was made from clear plastic and laid over the badges inside the sealed frames. As with the stepped mace symbol badges, a strong coherence was evident in the size and shape of the majority of badges. Plain mace symbol badges are probably also made with templates.

Arrow symbol badges

Arrow symbol badges are defined as sheet copper ornaments in the shape of projectile points (Appendix E, figure 16). Nineteen arrow symbol badges were available for study. They range in length from 4.0 cm to 8.8 cm, and in width from 2.1 cm to 4.0 cm. The thickness of the artifact is very similar to the thickness of the mace symbol badges, 0.05 cm or less. Manufacture of the arrow symbol badge is identical to that of the mace symbol badge, except that there is no evidence of template use. None of the arrow symbol badges analyzed are similar in size, although all are roughly the same shape. An attachment/suspension hole was biconically drilled in each arrow symbol badge, a feature

common to all of the symbol badges. Many of the badges were found in burials alongside the skull, suggesting that they may have been hair ornaments. Arrow badges are known primarily from Etowah. The best representatives have been attached to support cloths and sealed inside of frames, making exact measurement impossible.

Feather symbol badges

Feather symbol badges are flat sheet copper ornaments in the shape of feathers, often with embossed designs (Appendix D, figure 30; Appendix E, figure 17); and are primarily from Etowah. The best examples have been attached to support cloths and sealed inside of frames, making exact measurement impossible. Nine feather symbol badges were relatively accessible for study. They range in length from 6.5 cm to 14.0 cm, and in width from 2.8 cm to 4.7 cm. The majority of the feather badges are glued to support clothes making it difficult to determine thickness. Nonetheless, the thickness of detached feather symbol badges is approximately 0.05 cm. Manufacture of these artifacts is the same as for the other badges. There is no evidence of template use.

Raptor claw/talon symbol badges

Raptor claw/talon symbol badges are defined as thin sheet ornaments cut-out in the shape of a raptor's talons surmounted by a rectangular plaque with a "four wind" symbol (Appendix D, figure 31; Appendix E, figure 17). Two raptor

claw/talon symbol badges were available for study. They range in length from 8.6 cm to 8.8 cm and in width from 4.3 cm to 4.9 cm. The thickness of the artifact is very similar to the thickness of the mace, arrow, and feather symbol badges, 0.05 cm or less. The fabrication technique for this artifact differs significantly from the other symbol badges. The raptor talon symbol badge is invariably made from two pieces of copper sheet instead of a single sheet. Rolled tube rivets are used to secure the pieces together. The positioning of the rivets does not vary between the badges, always falling halfway up the raptor's leg. If the rivets had been positioned at the base of the rectangular plaque, this might suggest separate manufacture of the component symbols and later joining. Nevertheless, this is not the case. The symbols are treated by the native artisan as a coherent whole.

Raptor talon symbol badges are not larger than the other symbol badges, they are smaller. Why are they the only symbol badge made of two pieces of copper sheet? There is no clear answer. Two raptor talon badges (Etowah#s: 1149-1, 1149-2) recovered from the cache at the foot of burial #109 shed some light on the situation. When first examined one of the raptor talon symbol badges (Etowah# 1149-2) appeared to have an "extra" piece. This "extra" piece had two embossed lines. One of the lines matched an accidentally over-extended line on the symbol badge. The

other embossed line was on the opposite side and did not link to anything. The "extra" piece was in fact a piece of copper sheet that had been detached during the manufacture of the raptor talon symbol badge. The extraneous embossed line suggests that this artifact type is being made from scrap left-over from other embossed artifacts. Hamilton, Hamilton, and Chapman (1974) observed that some of the larger copper plaques at the Spiro Mound had been repaired with fragments from dissimilar decorated plaques. They suggest that decorated plaques are not simply sacred (set aside for special purposes) but considered to be holy (that is they contained intrinsic power). Damage would be interpreted as a lessening of power. Repair of slightly damaged "holy" artifacts with fragments from other more severely damaged (perhaps older) "holy" artifacts might have been a way to restore (or continue) the intrinsic power of the artifact. Their speculative syllogism is interesting. Raptor/warrior beings and their identifying characteristics appear to have held a place of veneration at both Spiro and Etowah (Brown 1985). Talon symbol badges are probably a part of the physical manifestation of the raptor ritual that is depicted on the raptor/warrior plates. Talon symbol badges may have been made from the scrap left over from the manufacture of the larger raptor plaques. Unfortunately, at the present time this speculation can not be tested.

Copper Headdresses

A headdress is defined as a large copper ornament made to be worn on the head. Several different types of headdress were found at Etowah. They are, in descending order of frequency, bilobed arrows, maces, effigy shells, ogee eyes, raptor wings, and deer antlers. Although the symbol badges were found primarily on or near the head, and a headdress was made of a number of mace symbol badges, it is not clear that the primary intent of the symbol badge was as a headdress. The six different headdress types identified above were used as such exclusively. Attachment of the headdresses is uncertain, although most of the artifacts have drilled holes.

Bilobed arrow headdress

The bilobed arrow is defined as an arrow and shaft bisected perpendicularly by another shaft. The ends of the second shaft terminate in lunate shapes or lobes (Appendix D, figure 32). Two bilobed arrow headdresses were available for study. Their dimensions are 17.0 cm x 19.3 cm and 25.5 cm x 20 cm. Thickness for the pieces can not be accurately determined due to corrosion. Nevertheless, the metal is approximately equal to or less than 0.05 cm. Fabrication of the bilobed arrows is essentially the same for all of them. Copper is hammered and annealed until it forms a thin sheet. This sheet is ground smooth by sandstone abraders. A smooth round tipped tool (e.g., antler or bone) is used to impress

the outline design and the excess material is removed by grinding through the raised line. Interior design lines are used to help position an oblong sheet of copper that forms the second side for the support socket (Appendix D, figure 32). This second piece of copper was held in place by rolled tube rivets. The support socket and rivet positions do not vary from headdress to headdress. Decorative lines are sometimes added to the support flanges that connect the lunate forms to the central arrow shaft. These lines may have a practical function and stiffen the region to minimize breakage through warping. Other decorative lines are sometimes added to the lunate edges of the bilobed headdresses. In all cases, these headdresses are manufactured from a single sheet. The patchwork that appears on several of the bilobed headdresses are repairs of damage sustained during use. Xeroradiography shows the cracks under the patches to be consistent with stress cracks resulting from use (e.g., Appendix E, figure 18). Bilobed headdresses are used by the living, they are not simply burial furniture.

Templates may have been used in the manufacture of the bilobed headdresses. Unlike the mace symbol badges, support for this idea is not based on exterior measurements of the artifacts. In this case exterior measurements are misleading as they reflect the portions of the artifact that have received the greatest attack from corrosion. The

interior angles and cut-out portions of the headdresses are better protected and are very similar. This coherence, coupled with the similar placement of rivet holes for the support socket, suggests the possibility of a template.

No specific template has been found at Etowah or Lake Jackson. Nevertheless, at the Etowah site several small pieces of sea turtle shell had been cut into the shape of bilobed arrows. The punctates on these ornaments were located in the same areas as the rolled rivets used to attach the support socket on the full size copper headdresses. Lines scribed on the turtle shell bilobed arrows coincided with incised decorations on the copper bilobed arrows. Unfortunately, the extant sea turtle shell artifacts are too small to be templates. Larger sea turtle shell ornaments were recovered at the site and analyzed by this study. Although fragmented and warped, it is possible to determine that these shell artifacts are shaped into various designs, including, large bilobed arrows with appropriately placed punctates. Accurate correlation of features found on the shell bilobed arrows to those found on the copper ones is difficult due to the severity of the warpage. Nonetheless, they appear to be generally congruent. Larson (personal communication, 1987) suggests that the turtle shell artifacts are primarily ornaments. This is likely for the smaller shell artifacts. Nevertheless, the larger shell artifacts would have been

suitable as templates or teaching devices in an unwarped state.

Mace headdress

A mace headdress is defined as a large sheet copper ornament cut-out which resembles a stone mace in silhouette (Appendix D, figure 33). Two mace headdresses were available for study. Their dimensions are 23.0 cm x 6.5 cm x 0.05 cm and 15.0 cm x 3.0 cm x 0.05 cm. Mace headdresses are very similar to the bilobed arrows in manufacture. Copper is hammered and annealed until it forms a thin sheet. This sheet is ground smooth by sandstone abraders. A smooth round tipped tool (e.g., antler or bone) is used to impress the outline design and the excess material is removed by grinding through the raised line. Interior design lines are used to help position an oblong sheet of copper that forms the second side for the support socket. This second piece of copper was held in place by rolled tube rivets. The support socket and rivet positions do not vary from headdress to headdress. Decorative lines are added to the mace headdresses to accentuate various features. Some of these lines may function as stiffeners for areas of the artifact which would have been stressed by use. There is no evidence that templates are used to make the mace headdresses.

Effigy shell headdress

Effigy shell headdresses are defined as copper overlaid wooden hair buns carved to resemble the whorl of a busycon shell (Appendix D, figure 34). Two effigy shell headdresses were available for study. The diameters of the effigy shell headdresses are practically identical, 7.8 cm and 7.5 cm, a difference of three millimeters. The width of the two wooden forms vary by a single millimeter, 5.0 cm and 5.1 cm. It is not possible to measure the metal t5thickness of these artifacts because of corrosion. Nevertheless, given the deeply carved wooden whorl it is unlikely that copper sheet thicker than 0.05 cm would adequately conform to the design. Fabrication of these artifacts starts with the carving of a soft wood form. Tool marks left on the interior of the wood artifacts suggest that both stone and shark tooth tools are used for carving. Two biconically drilled holes are made opposite one another in the lip of the wooden form and hold the pin that secures the effigy headdress in place. Moorehead (1932:69) thought that similar headdresses from his excavation represented the coils of a serpent and were worn on the top of the head. Nevertheless, the statues recovered from the site show the headdress being worn at the base of the skull (Moorehead 1932:12, 16). It is interesting to note that all the male statues from the Etowah site wear the headdress, where as only one of the female statues wears a shell headdress.

This female statue has been identified by Prentice (1986) as being an analog to the Birger figurine, a representation of Grandmother Earth. Prentice (1986:239-266) states that Grandmother Earth is a divine representation of creation, death, and rebirth. The shell effigy headdress could be derived from the shells that Grandmother Earth is supposed to carry with her (Prentice 1986).

Open eye/ogee headdress

An open eye/ogee headdress is defined as a rectangular copper plate which has as its main or only design an open eye (Appendix D, figure 35). Two ogee headdresses were recovered from the Etowah site. The first (Etowah# 463) is from an adult male burial (#25) which contained a super abundance of elite materials and ceremonial containers. It measures approximately 25 cm in length and 24 cm in width. The thickness could not be determined since the piece is glued to a support cloth inside a frame. The second (Etowah# 910) is from a male child's burial (#64), and measures 6.4 cm in length by 6.4 cm in width and less than 0.05 cm in thickness. The two headdresses are identical except for size. Larson (1971) suggests that the matching headdresses are the result of ascribed status. Fabrication of the headdresses follow identical techniques. Copper nuggets or laminar plate are hammered and annealed to the desired thickness and size. The sheet is ground smooth with a sandstone abrader, and a

square outline is embossed into the sheet. The raised line is ground through and a smooth round tipped tool (e.g., antler or bone) is used to emboss the surface design. Two central holes are drilled through the headdress for attachment. Both headdresses are made from single copper sheets. The larger headdress has repaired areas that coincide with stress points made through use. As with the bilobed arrows, these artifacts are used by the living and are not simply burial furniture.

Raptor wing headdress

A raptor wing headdress (Etowah# 442) was recovered from the Etowah site (Appendix D, figure 36). It was interred with an adult male (Burial# 120) and found covering the head. The headdress measures 22.8 cm in length and 20.0 cm in width. The metal thickness could not be determined, since the piece is sealed within a frame. The manufacturing process used to make the raptor wing headdress is identical to the one used to make the ogee plate headdresses. Copper nuggets or laminar plate are hammered and annealed to the desired thickness and size. The sheet is ground smooth with a sandstone abrader, and the wing outline is embossed into the sheet. The raised line is ground through and a smooth round tipped tool (e.g., antler or bone) is used to emboss the surface design. Four attachment holes are drilled through the edge of the wing. Analysis of the wear around the holes and the placement of the artifact in the burial

suggest that the wing was tied in an upright position (e.g., feathers up, attachment holes down). A single sheet of copper is used to make the headdress.

Two patches held in place by rolled tube rivets are observed on the headdress. One patch is located between the two middle attachment holes and apparently repairs a crack caused by bending. The other patch is located across the outstretched section of the wing and may also repair a crack caused by bending. It seems unlikely that the damage would occur or be repaired if the headdress was only used as burial furniture.

Deer mask headdress

A deer mask headdress (Etowah# 1723) was also recovered from the Etowah site (Appendix D, figures 37, 38). Unfortunately, the headdress was in a state of almost total decay. One antler made from copper sheet was sufficiently whole to allow for measurement. It measured 12 cm in length by 4.5 cm in width and with a thickness of 0.8 cm. A replica of the mask was made soon after its recovery. It depicts a deer being composed of a human face with wide shell eyes and bared shell teeth. Two antlers were laced to the top of the mask. Fabrication for this artifact closely follows the techniques for the manufacture of the shell effigy headdresses. Three pieces of wood are carved to the desired shapes and insets for the shell are carved in the main body of the mask. Copper is hammered and annealed

until it becomes a foil. The foil is used to overlay the carved wood pieces (based on foil adhering to the remaining fragments). The shell eyes and teeth are added to the main part of the mask after it is overlaid with foil. The antlers are laced to the mask as the last step. This headdress differs markedly from the deer headdress already mentioned for the Hopewell site. In this earlier case the headdress was composed of a curved copper plate and copper clad wooden antlers that was worn on top of the head. The Etowah headdress covers the front of the face and a portion of the head.

Raptor/Warrior Being Plaques

Raptor/warrior being plaques are found at both sites. Five plaques were available for study, two from Etowah and three from Lake Jackson. They depict either a person wearing a raptor costume or a composite being. It is not possible to accurately measure these artifacts due to corrosion and the conservation techniques used to stabilize them, an approximation follows. The plaques range in length from 40.6 cm to 57.0 cm, and 15.0 cm to 23.0 cm in width. Metal thickness can not be accurately determined due to corrosion. Nevertheless, it is likely that the metal was originally less than 0.1 cm thick. The manufacturing techniques are straightforward. A native copper nugget or laminar plate is hammered and annealed until a sheet of the desired size and thickness is obtained. The surface design

is embossed using a smooth round tipped tool (e.g, bone or antler). Patch repairs have been made in antiquity on all the raptor being plaques. The damage to the plaques appears to be caused by abrasion rather than stress. Design areas of the raptor being plaques are worn through making holes that need to be repaired. Patches of copper sheet are riveted over the holes, but do not hide them. Hamilton, Hamilton, and Chapman (1974) suggest that similar raptor being plaques recovered from the Spiro site were used in the green corn or busk ceremony. An integral part of the ceremony is the cleaning and polishing of sacred copper plates with sand mixed with wood ash. Sand and wood ash are highly abrasive. Sinkankis (1972) lists wood ash as being an effective stone cutting agent. The removal of surface copper by these agents is substantiated by experiment. A copper sheet (0.05 cm thick) was embossed with a series of raised lines. The copper was allowed to naturally oxidize in the open air for four weeks. Fine sand and sifted wood ash were mixed with water and rubbed by hand on the surface of the sheet. The copper oxide was removed within a matter of minutes and fine grooves and striations covered the surface of the sheet. The activity was continued for an additional thirty minutes, after which the raised portion of the metal was measured. A slight but noticeable loss of metal had occurred. Two days worth of intermittent cleaning (totaling 8 hours) demonstrated that the raised

designs could be worn down by aggressive cleaning. The high design relief common to the raptor being plaques would be subjected to even more abuse than the relatively low relief tested in the experiment. Nonetheless, a period of years would be required for the actual wear through of the plaques. This suggests that the plaques are a part of the living society, rather than burial furniture.

The individuals/beings represented by the plaques have a number of things in common. They are all wearing headdresses (e.g., bilobed arrows, plates), earspools, bead bracelets, bead anklets, sashes, kittles, and painted designs. Forelock beads and medicine bags/pouches appear on some of the plaques. The similarity of costume has been noted by a number of researchers (Larson 1971; Hamilton, Hamilton, and Chapman 1974; Phillips and Brown 1978; Brown 1985). Larson (1971) suggests that a form of dress bordering on a uniform was worn by elite individuals at Etowah. A discussion of the implications of this observation is presented in chapter six.

Raptor Dishes

Raptor dishes are a unique artifact form recovered from the Lake Jackson site (Appendix E, figure 19). They range in size from a length of 32.5 cm to 27.5 cm, a width of 14.5 cm to 19.0 cm, and a thickness of approximately 0.1 cm. The overall appearance of the raptor dishes are the same, a raptor with semi-furled wings and its head turned to

the side. The central body of the raptor has been sunk into a rectangular dish mold. The length and width of the plates varied when they were first manufactured, however it can be demonstrated that the central dish did not change in shape or size for at least two of the artifacts. The other dishes are too fragmentary to accurate determine any angles. Jones (1982) states that the dishes were found nested together, which would suggest that the central dish is similar for all of them. The raptor dishes are the only Mississippian artifact studied that appear to have shared a mold.

Copper Clad Earspools

The type of earspools reccvered from Etowah and Lake Jackson should not be confused with the earspools recovered from the Hopewell site. They are very different artifacts. The Etowah and Lake Jackson earspool form is actually a broad cone of wood sheathed in copper (Appendix D, figure 39). A pin/peg for attaching the cone to the ear extends from the point of the cone and is usually made from bird bone, although some wooden pegs have also been recovered. Twenty-four earspools were available for study. Earspools range in size from a diameter of 3.6 cm to 6.2 cm and a thickness of 0.4 cm to 1.7 cm. These measurements are a little misleading. Fabrication of this artifact is considerably more complex than is apparent at first glance. Wooden forms are biconically drilled and then carved into cones. The carving was precise enough that pairs of

earspools were recovered from the site whose measurements were routinely within 0.1 cm of each other. The biconical drill hole acts as a compression ring to firmly hold the carved bone or wood peg (the interior lip of the biconically drilled hole slips around a carved indentation on the attachment peg). A design such as a sun symbol (Etowah# 1147) may be carved by the artisan with a shark tooth tool on the flat bottom of the wooden cone (Appendix E, figure 20). Copper is hammered and annealed to a very thin foil and then wrapped around the wooden armature. In some cases, this takes the form of a two part copper cover. The first is cone shaped and fits over the wooden cone. The second is circular and fits the flat base of the cone. This second piece has an additional function as it overlaps the edge of the cone and secures the first piece in place. If the wood has a design carved into it, the thin copper is burnished into the hollows by a smooth tool (probably of bone or wood) and assumes the shape of the design. Earspools have the greatest dispersal of any copper artifact at Etowah.

Effigy Rattles

Effigy rattles are defined as copper clad wooden rattles which have been carved to resemble natural forms (e.g., busycon shells). There are three different types of rattle. They are, in descending order of frequency, raptor talons, bird heads, and busycon shells. The difference between the raptor talon and bird head rattles can only be

accurately determined when the copper cladding is extant, as the only difference between the two categories is the modeling of the copper sheet. Therefore, it is possible to discuss the two categories as if they were a single category.

Raptor talon/bird head rattles

Ten raptor talon/bird head rattles were available for study (Appendix D, figure 40). Raptor talon/bird head rattles range in size from a length of 7.2 cm to 8.2 cm, a width of 1.7 cm to 2.2 cm, and a thickness of 1.7 cm to 2.2 cm. The artifact is made by carving wood into a uniform rattle shape. The solid rattle form is split in half and a piece of wood is left extending from the base of the talon (or neck of the bird head) rattle. This piece of wood is rounded and becomes the handle of the rattle. The interior of the split rattle is hollowed out with a shark tooth tool and coarse quartz sand is placed inside. Copper nugget or sheet is hammered and annealed until it becomes a very thin foil. The foil is then molded to the rattle in two overlapping sheets. The overlap of the copper foil binds the wooden halves together. None of the rattles has copper foil applied to the handle of the rattle. The primary difference between a raptor talon rattle and a bird head rattle is an embossed line on the sheet that forms the eyes of the bird. This line is not carved into the wood of the rattle, but chased into the copper foil after it was

applied. Loss of the copper sheet, or corrosion in this area, makes it impossible to differentiate between the two forms accurately.

Shell effigy rattles

Two shell effigy rattles were available for study. Their dimensions are 4.6 cm x 2.2 cm x 2.0 cm and 5.2 cm x 2.4 cm x 2.4 cm. The rattles are made by carving wood into the shape of a busycon shell. The solid rattle form is then split in half. A piece of wood is left extending from the tip of the shell on one half of the rattle. This piece of wood is rounded and becomes the handle of the rattle. The interior of the split rattle is hollowed out with a shark tooth tool and quartz sand is placed inside. Copper is hammered and annealed until it becomes a very thin foil. The foil is then molded to the rattle in two overlapping sheets. The overlap of the copper foil binds the wooden halves together. The copper foil was not applied to the handle of the rattle. Except for the natural form being copied, there is no difference in fabrication technique between the different types of rattle.

Copper Clad Bodkins

Bodkins are long wooden pins partially clad in copper (Appendix D, figure 41). Three bodkins were available for study. They range in size from a length of 8.8 cm to 10.7 cm, a width of 2.0 cm to 2.2 cm, and a thickness of 0.2 cm to 0.3 cm. The metal is heavily

encrusted by corrosion and has an approximate thickness of 0.1 cm. The bodkins are made from light wood or cane carved in a half-oval cross-section, which is smoothed after carving. A thin copper sheet is wrapped around the upper portion of the wooden pin in two parts. A flat piece that closely conforms to the flat back is held in place by a larger rounded sheet that covers the front and overlaps the back edges. Tube rivets can be seen on the front of the copper sheet suggesting that another piece of metal may have been attached. Unfortunately, it is not possible to determine if the rivets are decorative or functional. Placement of the pieces in burial #45 near the right ankle does not suggest a use.

Copper Clad Finials

Finials are defined as roughly rectangular objects with a small rounded tab extending from a short side (Appendix D, figure 42). The use of these artifacts is presently unknown, but may have been as hair ornaments. Four copper clad finials were available for study. The finials range in size from a length of 4.4 cm to 6.1 cm, a width of 2.6 cm to 3.5 cm, and a thickness of 0.4 cm to 0.5 cm. In each case the finials are carved from a single piece of wood. While all the finials share the same shape, two of the finials (Etowah#s:1712, 1729-1) had raised parallel lines carved on one side. The three lines run the length of the artifacts. Copper foil is used to cover the finials'

front and back. The tab ends are not covered with copper. Insufficient copper remains on the finials to allow for any specific discussion of the metalworking used on these pieces. Nevertheless, the general process probably follows the techniques already discussed for cladding wooden artifacts.

Sun Gorgets

The sun gorgets are circular pendants with a cut-out design (Appendix D, figure 43). Two sun gorgets were available for study. They have diameters of 5.2 cm and 6.5 cm, and a thickness of 0.5 cm and 0.6 cm. The manufacture of this artifact represents an in depth understanding of cladding techniques. The wooden form is carved from a single piece of wood, and the interior cut-outs removed by careful chisel work. All sharp angles inside and outside the piece are rounded. Copper is hammered and annealed until it becomes a thin foil. Three separate sheets of foil are used for each gorget. Two of the sheets are of the same design as the interior of the piece (central hub with spokes). These pieces are made slightly oversize to allow the pieces to overlap the wooden form and each other. The third sheet is made as a long rectangular strip. This strip is applied to the outer edge of the gorget in a fashion highly reminiscent of early wheelwright work. The strip covers the outer edge and secures the free ends of the two interior sheets. Careful rubbing of the sheets with a

smooth tool ensures that the cladding closely conforms to the wooden form. It is interesting to note that the two interior sheets of this artifact closely followed the techniques used during the Middle Woodland at the Hopewell site for the manufacture of cut-outs.

Copper Beads

Copper beads are not common at either site. This is in marked contrast to the copper, silver, and gold beads commonly recovered from central and southwestern Florida sites (Leader 1985). Two bead forms were shared by both the Etowah site and the Hopewell site. The first is the common rolled tube bead. Two rolled tube beads were available for study from Etowah. This bead does not change in fabrication technique from its earliest form during the Late Archaic. Hammered copper sheet is rolled around a form, probably bone or wood, without being sufficiently annealed. Yield point stress marks are always present on these beads. Curation of earlier forms is highly unlikely due to the thinness of the metal, a factor which may skew the recovery record. The second form is hemispherical and closely resembles the buttons recovered from the Hopewell site. Six hemispherical copper clad wooden beads were available for study from Etowah. In both cases thin copper sheet clads a button form (sandstone at the Hopewell site, wood at Etowah) that gives support and strength to the artifact. Copper disk beads identical to the ones made in shell have not been recorded

for either site, although the shell ones are ubiquitous. It appears that copper was being selectively used for specific artifact forms. The common use of copper and silver for beads at the Fort Center site and other later Florida sites may be more directly tied to the influx of European transported metals than has been previously thought.

Copper Axes

Axes have been recovered from both the Etowah and Lake Jackson sites (Appendix D, figure 44). Sixteen axes were available for study, eleven from Etowah and five from Lake Jackson. They range in size from a length of 12.0 cm to 20.8 cm, a width of 9.5 cm to 4.5 cm, and a thickness of 1.3 cm to 0.3 cm. The axes are all made from single pieces of copper. Hammering, annealing, and grinding are the techniques used (Appendix E, figure 21). The axes are not annealed as a final step. Numerous tension cracks, edge exfoliation, and internal stress lines support a final hardened state. Individual variations in overall size and treatment of the axes are probably tied to the initial size of the copper nuggets or plates. The axes show no signs of use, although they were hafted. The haft lines are clearly evident on the surface of the metal, and several hafts are still attached to the axe heads. These hafts are of carved wood with a rounded knob finial identical to the typical monolithic axes of the period (Waring and Holder 1945). A decorative edge treatment is unique to an axe from the Lake

Jackson site (Lab# 2846). Small ground lines radiate inward perpendicular to the round axe edge. The decorations would not enhance the use of the axe, and probably ensure that it could not be used. It is interesting to note that the basic shape and manufacturing techniques for axes have not changed from the Middle Woodland.

Metalworking Tools

The tools that are necessary for the manufacture of the artifacts discussed are available in large quantities at the Etowah site. A brief discussion concerning identified tools follows.

Deer antler points

Deer antler points are common in the fill of Mound C, and may have been used as projectile points and as pressure embossers for copper. A diagnostic feature of antler point embossers are the tell-tale drag lines left in the bottom of the design furrows. These shallow striations commonly run parallel to the furrow's sides, and are the result of the slight cutting action of the bone facilitated by body pressure. Experimentation with fresh antler tips resulted in effective furrows with similar striations. The furrows are seen in the majority of the electrolysed plates from Etowah. Plates that do not have these marks tend to be decomposed or were improperly cleaned by hand. The latter are easily identified by their sharply defined random

scratches resulting from overzealous application of a wire brush.

Shark's teeth

Shark's teeth that have been modified for hafting abound at Etowah. The few analyzed in this study demonstrate the softer wear consistent with the working of wood. Considering the large quantity of wooden artifacts from the site that were carved in preparation of copper cladding, this is not surprising. The seriations present on shark teeth leave an unmistakable mark in the wood as it is carved (Appendix E, figure 20; Leader 1985). Several hundred teeth representing just a few species were recovered from an elite burial at Lake Jackson (Jones 1982). Similar shark teeth representing the same species were recovered from the Etowah site. It is interesting to speculate on the possibility that the Lake Jackson site may have supplied shark's teeth to the Etowah site. This would help to explain the copper artifacts found at Lake Jackson that were made at the Etowah site. Regardless of the final source of the teeth, the use of shark teeth at Key Marco (Gililand 1975), Fort Center (Schwehm 1983; Leader 1985), and Etowah should result in evaluation of these materials as serious wood working tools when they are found at a site.

Stone tools

Hammerstones and sandstone abraders suitable for the thinning of copper have been recovered from Mound C.

Grinding marks left by abrasion are often encountered on the copper artifacts in areas protected from corrosion or cleaning. The sizes of the abraders in the Etowah collection are quite interesting as they range from hand held tools 6.4 cm long, 2.5 cm wide and 0.6 cm thick to sheets 30 cm long, 20 cm wide and 6 cm thick. Although these tools are often mistaken for hones, they lack the furrows associated with the sharpening of edged tools. Rather, the stone surfaces have an overall smoothing commensurate with the techniques already discussed for manufacturing specific copper artifacts. There proper identification is as stone abraders. The stone abraders could be easily handled regardless of size.

Polishing media

Raised areas on the plates commonly showed a higher "polish" than areas in lower settings. This is very likely to be the result of polishing the surface with wood ash to highlight the design. This ties in well with the replication experiment already discussed , and with the interpretations of Hamilton, Hamilton, and Chapman (1974).

Wood ash and fine sand have been used as a metal polish for millennia in most parts of the world; the opal phytolith component being the active polishing agent in the wood ash (Biringuccio 1966; Sinkankis 1972; Rovner personal communication 1986). The cutting action of these materials should not be underrated. Over time the resulting abrasion

from the polish would thin the metal, especially raised areas of the design, making it prone to splitting. It is not surprising that the majority of the plaques found at Etowah and at other Mississippian sites have repair plates. Nor is it surprising that holes (as distinct from cracks) almost invariably start in in design elements.

The question first raised by C. B. Moore in 1894 as to the use of single copper sheet versus "patchwork" for the manufacture of copper plates can now be answered, at least for Etowah and Lake Jackson. Large copper ornaments (e.g., raptor/warrior beings, four winds/open eye breastplates/headdresses) invariably start as single pieces of copper sheet. Patches are added to these pieces at a later date as repairs due to accidental breakage or wear. A logical extension of these data is the assertion that the pieces are not primarily funerary in function, since wear argues for use over time. Single ownership is suggested for the later time periods as relatively unworn and badly worn large copper ornaments are interred together in individual burials containing mature adults. The implications of these points will be discussed in chapter six.

Summary

In summary this chapter has examined the technology used to make copper artifacts during the Mississippian time period (A.D. 900 to European contact). Artifacts from the Etowah site, the Lake Jackson site, and Fort Center site

collections have been analyzed. The data generated by the analyses are combined with the results of prior analyses to produce new interpretations for each artifact type.

Unfortunately, none of the artifacts or tools discussed in this chapter have been recovered from a demonstrable workshop. This is not disheartening, since the only portion of the Etowah site that has been thoroughly investigated are the burials in Mound C. A large portion of the village area synchronic with Mound C has yet to be investigated. Workshops are most likely to be located in this area. It is possible that no metal artifacts will be found in a workshop. The interment of copper debris with the copper artifacts from which they were made is supported at the site, as is the use of scrap to make distinct artifacts or repairs. The possible ownership of the raw material as well as the finished artifact raises some interesting questions. The implications and interpretations resulting from this portion of the study will be integrated within the broader question concerning specialization in metalwork during the prehistoric period in the eastern United States, in chapter six.

CHAPTER SIX
TECHNOLOGICAL STANDARDIZATION AND SPECIALIZATION

Introduction

This chapter discusses the evidence for specialization in metalwork during the Archaic (3,000 B.C. to 1,000 B.C.), Middle Woodland (200 B.C. to A.D. 400), and Mississippian (A.D. 900 to European contact) time periods. The discussion is based on the analysis and interpretation of data from three metal artifact collections, the Old Copper Industries collection (Late Archaic time period), the Hopewell collection (Middle Woodland time period), and the Etowah collection (Mississippian time period). The first two collections are curated at the Field Museum of Natural History, Chicago, and the last collection is housed at the Etowah Museum, Cartersville, and West Georgia College, Carrollton. A clarification of some basic terms and concepts is first presented.

This study defines a specialist as an artisan who possesses unique knowledge of a skill and plies that skill. Specialization is defined as the collective actions of the individual specialist or specialists. These terms are the cornerstone of any discussion of specialization. Recent

researchers have used these basic definitions for very different purposes (Yerkes 1983; Prentice 1983, 1985; Muller 1984), some of which will be discussed below.

A specialist practices his/her trade by definition, but is this full-time or part-time?. Yerkes and Prentice (Yerkes 1983; Prentice 1983, 1985) allow for the inclusion of part-time involvement, while Muller (1984) prefers it to mean full-time practice. Prentice suggests that some specialists during the Mississippian period worked part-time, were located in outlying areas, and produced materials for regional markets, a situation he refers to as "cottage industries " (Prentice 1983, 1985). Prentice presented an analysis of materials and tool kits recovered from isolated Mississippian farmsteads located in southwestern Illinois and eastern Missouri to support the idea. The analysis focused on the large quantity of shell blanks, shell beads, and microdrills recovered from some of the farmsteads. Micro-drills have been identified by Yerkes (1980:323) as being specialized tools for the working of shell. Prentice hypothesized that the demand for shell artifacts may have supported full-time specialists at larger sites (e.g., Cahokia) and part-time specialists in outlying areas (Prentice 1983:33-35, 40-41). Muller took exception to the concept and stated that the delineation of specialists engaged in part-time work in outlying areas was perilous at best, and that markets have not been demonstrated for the

time period or area (Muller 1984). Prentice's use of the term market may have been over interpreted by Muller, a point which Muller admits (Muller 1984:493). Rather, Prentice may have been referring to the effects of demand for a product, rather than to a market in the formalist sense. Muller (1984) feels that the discipline's confusion concerning specialization comes from a failure to equate specialization with full-time participation, group (versus individual) standardization, and producer versus site specialization.

Muller provided a practical demonstration of his concerns by testing the level of specialization at a site in southern Illinois (Muller 1984). Muller chose the Great Salt Spring site for two reasons, salt production had been identified as a specialization (Driver 1961:172), and the site had been identified as a special use site where extraneous activities would be minimal. The second point was of great importance to Muller, since it removed any obscuring activities that might interfere with interpretation. Muller's analysis confirmed that the site was a special use site and that the most commonly recovered tool were saltpans (Muller 1984:497-498). Muller declined to call the manufacture of salt at the site a specialty for several reasons, the saltpans differed in size, the quantity of wood in the area had proved insufficient for early colonial salt production and therefore could not have

supported prehistoric Indian full-time specialization, and the "various tools do not show the degree of "standardization" that would be expected if production here had been by full-time specialists." (Muller 1984: 492, 505). He does conclude that the site demonstrates specialization, but not producer specialization (Muller 1984:505-506).

Muller is probably correct that the Great Salt Spring did not support specialists, but for reasons different from those he has presented. The varying size of the saltpans used at the site was probably tied to individual ergonomics. The water was carried in the containers from the spring to the evaporating hearths. Water filled containers are heavy and difficult to move making them prime candidates for individual modifications for reasons of comfort. The saltpan functions would remain the same but the overall size and shape would (and did) vary. The hearths on the other hand, were reported by Muller as being very similar if not identical (Muller 1984:502, 504). The clay-lined hearths are specialized tools for evaporating the salt water and are not subject to ergonomic factors that might cause individual alteration. Task concerns would ensure that they would be nearly identical. The failure of the area to support commercial salt production cannot be considered a fair estimate of prehistoric capacity. The differences and mitigating factors are too numerous to recount. Nevertheless, Muller's

(1984:506) suggestion that salt production was cyclical and thus did not over-burden the area is an explanation for the continued use of the area by the Indians. Salt stores easily, does not rot, and can be supplemented by other organic materials (e.g., animal blood). Muller's insistence on group standardization is an important point that will be dealt with separately below.

The definition previously given for a specialist includes the idea of unique knowledge of a skill, there is nothing unique about evaporating water to make salt. Salt manufacture is not a complicated task and full-time specialization seems unlikely from the outset. The area of Illinois in which the Great Salt Spring is located has numerous smaller salt springs. Salt value would increase proportionally the further away from the salt producing area one went (Sahlins 1972). Trade in salt is more likely to occur in a noticeable fashion in the outlying areas, not the central core. A surplus of salt from the region's springs would make full-time specialists at any one site unnecessary.

Logically, there is no intrinsic reason why a specialist must work full-time in a central place. The existence of full-time or part-time specialists within a society is tied to the role that the specialized skill fills within the society. The possession of specialized knowledge

or ability does not guarantee a continuous need, rather it guarantees a service at need.

Muller prefers to focus on full-time specialists working in a centralized location (Muller 1984:505). His decision is based on a valid concern. Studying part-time specialists working in outlying areas make analysis difficult. Muller is attempting to keep the research as unambiguous as possible. His reliance on standardization as a way of describing the product of specialists is in keeping with this perspective. Muller's (1984) use of standardization means a coherence or similarity of all the facets of a task being undertaken by specialists. This will be referred to in this study as group standardization, since it is concerned with group similarities. Muller's insistence on group standardization makes it easier to recognize specialists through their products and tools, although it has a few drawbacks. Historically, group standardization has often been a measure of coercion rather than of specialization. Group standardization of specialists and their products in Europe tended to result from such things as internal and external abuse, political/economic manipulation by vested interests, and health concerns (c.f., Gimpel 1976:21, 22, 105; Thorndyke 1956:245-246, 301-302). In each case, specialists (and by extension specialization) existed before the imposition of group standardization. It should be kept in mind that

standardization (as used by Muller) is relatively new for Western European societies, it is not an acceptable expectation for the New World.

Muller's and Prentice's concerns are legitimate. The differentiation between full-time and part-time specialization, and individual versus general standardization are serious questions; but, they are markers of resource use intensity and cultural complexity, not specialization. Evans (1978) produced a list of criteria that he felt clearly identified the presence of specialists at a site. His intent was to identify the presence of unambiguous specialization. Evans lists six points as being central to the determination: 1. workshops: specialized areas for craft activities; 2. tool kits: specialized tools for craft activities; 3. storage facilities/Hoards: areas for the stockpiling of completed craft items; 4. resource exploitation: regular exploitation of particular resources; 5. exchange and trade: distribution of craft products; and, 6. differential distributions: unequal dispersal at the site.

Evans' polythetic definition by-passes the question of full-time or part-time specialization, regardless of place or duration of an activity, specialization is demonstrated as long as the criteria are met. Polythetic definitions are rarely equally weighted (c.f., Thomas 1972:300-303). Compliance with a polythetic definition is

demonstrated by a high level of "fit," point for point similarity is not expected. Failure to demonstrate a sufficient number of criteria results in either the object of the research failing to meet the criteria, or redefinition of the criteria. Evans' test defines the indicators of specialist presence without recourse to a priori exclusions, a distinct advantage. Nevertheless, care must be taken not to alter the intent of the criteria by redefinition. The following sections provide an analysis of specialization in metalworking during the Archaic, Middle Woodland, and Mississippian time periods. A discussion and summary are presented after the last section.

Archaic Period

This section discusses the evidence for metalworking specialists in the Old Copper Industries during the Archaic period. Data from the analysis presented in chapter three is integrated with earlier analyses to provide information that specifically address Evans' criteria. The criteria are used to order the section's data for presentation.

Workshops

Metal artifact workshops have not been identified for this period. The majority of Old Copper Industries artifacts were recovered as single finds (Wittry 1951:2; Griffin 1960; McHugh 1973:74; Vernon 1985:154). None of the artifacts from the Old Copper Industries collection (Field Museum of Natural History, Chicago), came from metal

workshop areas. The hunting and gathering lifestyle of these prehistoric peoples (Quimby 1960; Fitting 1975; Griffin 1983:249) probably necessitated mobile workshops. The tools used to make the artifacts were simple (refer below) and readily portable. Little debris would be left to mark a temporary workshop. Evans' workshop criterion calls for a specialized area of work, this cannot be supported for the Old Copper Industries at the present time.

Tool Kits

Evans' (1978) tool kit criterion refers to tools used to manufacture the artifacts being studied. The data presented in chapter three suggests that the tools used to make Archaic copper artifacts were simple and undifferentiated from other tasks. Hammerstones, anvil stones, abraders, drills, campfires, and mandrels were the tools used. These tools, with one exception, are also used to make stone, bone, or shell artifacts. Mandrels are the exception and were used to make rolled tube beads, as such they are specialized tools. A suitable twig from a tree could have been used as a mandrel. Survival or recognition of this artifact in the archaeological record is unlikely.

Griffin (1961) provides a wealth of data concerning the tools and techniques used to acquire copper from the Lake Superior region. The tools used include hammerstones, wooden shovels, wooden bailing containers, fire, and leather cordage. Hammerstones and fire have been discussed above,

and leather cordage is not a specialized tool that can be linked to mining activities alone.

Wooden tools from Isle Royale were recovered in the 1800s from flooded mining pits where they had been preserved underwater (Griffin 1960:53). The description of wear on the shovels suggests that they may have been specialized tools used in mining native copper. Unfortunately, no dates can be assigned to them and they have since disappeared.

Mandrels are specialized tools and wooden shovels may be specialized tools. Evans' criterion specifies tool kits, two tools from different contexts cannot be called a tool kit. This criterion cannot be supported for the Old Copper Industries at this time.

Storage Facilities/Hoards

The majority of the Archaic copper artifacts are single finds; however, some have been recovered from deposits and burials. Griffin (1960:103-117) refers to a number of deposits that were recovered by earlier excavators, and a cache/deposit from Sault Ste. Marie was discussed in chapter three. The Sault Ste. Marie deposit was distinguished by its lack of hunting paraphernalia, it contained awls and pins. Vernon (1985:155) analyzed several metal blanks from a "workshop" located in Houghton, Michigan. Nevertheless, the background that Vernon provides for the material in his thesis (1984:39-40) suggests that the material is from a deposit, not a workshop. The blanks

were located in a single location by an amateur with a metal detector and turned over to Professor Witthoft. No work has been done in the specific area of the recovery that might suggest the presence of a workshop.

Binford (1962:221) stated that the majority of the Archaic copper artifacts had been placed in burials. This would suggest that Archaic burials were functioning as significant deposits for artifacts. McHugh (1973:72-75) in his critique of Binford discussed the burial data available at the time. The Osceola, Oconto, and Reigh sites had produced burials and Archaic copper artifacts and were the database available to Binford. The Osceola site produced the majority of its copper artifacts from areas not associated with burials (Ritzenthaler 1946:55-56). The proveniences of the copper artifacts recovered from the Oconto site were confused and contradictory (Ritzenthaler and Wittry 1952: Appendix A). Nine of the Oconto site's copper artifacts came from an area that included twenty-nine burials, twelve artifacts came from a habitation area, and five were from a private collection with unknown proveniences. The Reigh site (Ritzenthaler 1957) did produce thirteen burials which had a few copper artifacts; however, there were thirty-nine burials at the site. Twenty thousand copper artifacts are known for this time period and an insignificant amount was placed in burials. It is very

unlikely that Late Archaic burials were significant deposits of copper artifacts or storage facilities.

Evans' criterion is best fulfilled by the non-burial deposits that may have functioned as storage areas. Unfortunately, there has been little analysis of these possible caches and of the surrounding areas. The Sault Ste. Marie and Houghton, Michigan deposits may have been temporary storage but there is no way at present to accurately determine this. Evans' criterion cannot be supported by the data.

Resource Exploitation

The regular exploitation of specific resources is the central point of this criterion; matching specific sources with specific artifacts. A number of researchers have studied the distribution of Archaic copper artifacts and mine locations and concluded that the majority of the artifacts came from mines in the immediate area (Fogel 1963; Steinbring 1975). Regular exploitation and intensive use of the mines has also been demonstrated (Griffin 1961; Drier 1961; Bastian 1963). Are the regional identifications sufficient for Evans' criteria? The answer is a qualified yes. Evans uses broad geographical areas for sources of raw materials in his own analysis to fulfill the criterion (Evans 1978). Nevertheless, specific identification of sources is more valuable than general identification. This

kind of determination is the province of source studies and trace element analysis.

Trace element analysis has made significant strides since Bastian's (1961) seminal article. In this article Bastian discussed analyses that had been done in the past and decried the lack of comparable data, standards, and test replicability (Bastian 1961:167-170, 175). He concluded that the potential for source identification was great and untapped. The introduction of new techniques and comparative standards has improved the reliability and replicability of trace element studies.

Goad (1978:55-88) used optical emission spectroscopy and neutron activation to analyze a number of ores and artifacts from a variety of sites, areas, and time periods. The controls for these tests were derived from Bastian's (1961:162-166) data set (Goad 1978:60). Unfortunately, Goad (1978:93) didn't include Archaic copper artifacts in her study; however, she tested fifty-one samples of ore from Wisconsin and Michigan. The foundation exists for tightening Archaic copper source identification. Evans' criterion for resource exploitation is supported for the Archaic artifacts of the Old Copper Industries, although clearer identification of specific resources needs to be obtained.

Exchange and Trade

The exchange of copper artifacts in the Lake Superior region during the Late Archaic has attracted a number of researchers (Fogel 1963; Steinbring 1975; Goad 1978). Their analyses show that the quantity of copper artifacts recovered from sites rapidly diminishes as the distance from the suspected sources increases (Fogel 1963:154-157, 159; Steinbring 1975:379-380; Goad 1978:89-106). The character of the copper artifacts recovered from sites also changes as distance increases. Utilitarian copper forms common to the Old Copper Industries of the Lake Superior region are gradually replaced by ornamental forms as the distance from the region is increased (Winters 1968:199). Goad (1978:96) suggests that hand-to-hand reciprocal exchange best accounts for the behavior, and further suggests that the pattern was based on multi-directional small exchanges between relatively small groups (Goad 1978:98).

The level of trade or exchange is less important to Evans' criterion than its demonstrated existence. Trade can be demonstrated for Old Copper Industries artifacts, therefore this criterion is upheld.

Differential Distributions

The majority of Old Copper Industries copper artifacts were recovered as single finds without data concerning associations. The lack of data concerning

association and chronology makes it impossible to accurately assess differential distribution. The copper deposits that are occasionally recovered could be interpreted as differential distributions of artifacts if there was comparative data; however, the deposits have been rarely tied to a discernible site, time, or to other deposits. If the Old Copper Industries' copper artifacts had functioned as burial goods the derived data could have been used to address the situation, but they did not.

In a broad sense there is differential distribution between geographic areas within the region and outside the region (Miles 1951; Fogel 1963; Steinbring 1975). Nevertheless, this does not fulfill Evans' criterion. There is insufficient data to support this criterion at the present time.

Middle Woodland Period

This section discusses the evidence for specialization in metalwork during the Middle Woodland period at the Hopewell site. Data from the analysis presented in chapter four is integrated with earlier analyses to provide information that specifically address Evans' criteria. A discussion and summary are presented after the last section.

Workshops

Workshops are very likely at the Hopewell site, although specific metalworking areas have not been

identified. Stone, bone, and metal implements, nuggets, blanks, artifacts in early stages of manufacture, and repaired artifacts were recovered from the site (Moorehead 1922: 107, 128-129, 134-135, 143; Shetrone 1926:192-194; 201-203; 207-208). It is difficult to imagine the range of materials being present without a workshop in the vicinity. Debris from the manufacture of mica artifacts were recovered from within the site enclosure and numerous "books" of mica were recovered from Mounds 17 and 25 (Moorehead 1922:91, 92, 111; Shetrone 1926:190). Obsidian artifacts, debris, and raw material have also been recovered from the site (Moorehead 1922:131-132; Shetrone 1926:117, 118).

At the Seip Mound, excavation of a midden area within the enclosure uncovered the remains of seven structures that were not directly involved with mortuary activity (Baby and Langlois 1979). Numerous pits within the structures yielded sandstone and limestone cobbles, bone tools, shell (both freshwater and salt), chert and obsidian tools, fragments of mica and incomplete mica cut-outs, pottery fragments, and light habitational debris. No hearths or other indications of intensive habitation were recovered. Baby and Langlois (1979:18) conclude that the structures probably represent workshops that were used overtime and periodically leveled and rebuilt. A similar situation probably existed at the Hopewell site and went

unrecognized (Shetrone 1926:190; Pat Essenpreis and N'omi Greber, personal communication).

Tool Kits

The tools used to make the copper artifacts at the Hopewell site are similar to the tools used during the Late Archaic period. Hammerstones, anvil stones, abraders, drills, fires, gravers/scribers, pressure bossers, mandrels, templates, and sinking forms were the minimal tools necessary to make the Hopewell artifacts. This tool kit includes several specialized tools. Pressure bossers, mandrels, templates, and sinking forms were used to make copper cut-outs, effigy plates, rolled tube beads, and domed brooches. Pressure bossers were used to make the embossed effigy plates and to delineate the grinding lines of the copper cut-outs and domed brooches. The tool could have been made from bone, stone, or antler; however, the tool mark analysis suggests that bone or antler tools are the most likely. Some tools similar to the ones suggested were recovered at the site (e.g., sandstone abraders, bone pins, bone awls, bone gravers, stone and metal drills) (Moorehead 1922:102, 110, 129, 134-135, 149; Shetrone 1926:192-194, 201-203, 207-208). The mandrels and sinking forms were probably made of wood, where as a flexible hide is suggested for the templates. Although the mandrels and templates have not survived, their presence is indelibly fixed in the

artifacts that were made with them. Evans' tool kit criterion is supported at the Hopewell site.

Storage Facilities/Hoards

A large number of metal deposits were found at the Hopewell site. The largest metal deposits were recovered from Mound 25. A deposit of one hundred and twenty pieces of copper was found in one three foot by two foot section of the mound (Moorehead 1922:109). The copper artifacts had been carefully enclosed by bark sheets. A major copper deposit was also found overlying a double burial (#260, 261) Moorehead (1922:110) described this burial (#260, 261) as having a mass of material which, "exceeds that associated with any other burial so far discovered in the United States." His statement was not hyperbole, a rectangle seven feet by five feet was formed when the Indians laid out the overlapping materials in the grave. The recovered materials included at least sixty-six copper celts, twenty-three copper plates, a copper headdress, meteoric iron, partly worked copper, and fragments (thought to be from the plates; Moorehead 1922:110).

Deposits of finished craft materials, unfinished materials, and debris are well represented at the site (Moorehead 1922; Shetrone 1926; Essenpreis and Greber n.d.), but are they storage?. Burial deposits may be hoards but to fulfill Evans' criterion as storage there must be evidence of reuse. There is no evidence at present that any of the

deposited materials were reused. Nevertheless, there must have been storage facilities for the copper artifacts. It is unfortunate that the initial excavation of the site probably destroyed these data. Evans' criterion can not be supported at the present time.

Resource Exploitation

The number of metal artifacts recovered from the Hopewell site attest to the intensive exploitation of metal resources. The majority of copper was obtained from deposits in Michigan or from float deposits (Prufer 1964; Goad 1978; Carlson 1979; Seeman 1979). A few copper objects may have used metal from southeastern sources (Goad 1978), and Spence, Finlayson, and Pihl (1979:120) state that a few silver objects were made from silver obtained from the Cobalt region of northern Ontario. The iron used at the site was acquired from a meteorite located in Newton, Kansas (Wasson and Sedwick 1969; Seeman 1979:301; Carr and Sears 1985). Evans' criterion has ample support.

Exchange and Trade

The exchange or trade in artifacts from the Hopewell site is a little more difficult to support than the other sections. Caldwell's (1964) discussion of the Hopewell interaction sphere attempts to explain the occurrence of similar artifacts found at different sites as interaction between the different societies. A significant part of Caldwell's (1964:135-138) argument is that there is a

differential nature in the interaction between distinct societies. Streuver and Houart (1972:) extend Caldwell's concept by suggesting contemporaneity of sites that exhibited "Hopewellian" features, a uniformity of ideological concepts carried with the artifacts, hierarchical control of inter/intra-regional trade, specific sites as resource concentration areas, and the identification of entry level trading partners based on quantity and type of material recovered from a site. At this point, Evans' criterion would be amply supported. Unfortunately, Streuver and Houart's (1972:71, 75, 79) preliminary analysis overstates the nature of the interactions, blurring the distinctions and chronologies between groups, resulting in inaccurate estimates of artifact distributions. Seeman's (1979) analysis tests Streuver and Houart's analysis and upholds Caldwell's initial concerns. He finds that the exchange of artifact forms are limited during this time period and the majority of forms are retained in specific areas, such as the Scioto region of Ohio (Seeman 1979:411). The Hopewell site did not use trade to acquire most of its artifacts, rather raw materials were acquired and artifacts manufactured for use in the immediate area. Although Streuver and Houart overstated the situation, their analysis was a valuable study that has stimulated a considerable amount of research.

limited trade in small amounts did occur which is sufficient to support Evans' criterion.

Differential Distributions

Copper artifacts are differentially distributed at the Hopewell site. The deposits mentioned earlier, and the frequency and placement of both common and uncommon artifacts illustrate the point. Earspools are a common artifact at the site. Moorehead (1922:121) states that over four thousand of them were recovered, more than enough to ensure at least one for every mound and feature at the site. Nevertheless, the vast majority of earspools were recovered from two deposits in Mound 25. Copper celts are less common than earspools at the site, but are not rare. There are a sufficient number of celts to ensure distribution over the site if that choice had been made by the prehistoric people who made the site. Nevertheless, the majority were recovered from a burial (#260, 261) in Mound 25, although a few have been found elsewhere (e.g., FMNH#s: 56018, Mound 3; 56027, Mound 17). None of the metal artifacts at the site were deposited in a haphazard manner. The prehistoric Hopewell people very carefully put things in their place. The bark and cloth wrappings of some artifacts, and the careful arrangement of deposits and burial goods very clearly demonstrate this. Mound 25 is one of thirty-eight mounds originally located at this site (Shetrone 1926:93). The choice of this mound as the major depository for copper

demonstrates a case of differential distribution. The Hopewell site supports the criterion at several levels.

Mississippian Period

This section discusses the evidence for specialization in metalworking during the Mississippian period at the Etowah site. Data from the analysis presented in chapter five is integrated with earlier analyses and the combined database is interpreted in light of Evans' criteria. A discussion and summary are presented after this section.

Workshops

The workshop situation at the Etowah site is similar to the one at the Hopewell site. Copper artifacts in all states of finish and repair were recovered from the site, as were copper debris and tools. Nevertheless, a specific workshop has yet to be identified. The difficulty probably lies in the lack of information concerning the contemporary village site adjacent to the mounds. Mound C is the only mound that has been extensively excavated and the mound fill contains quantities of village refuse and tools (Kelly and Larson 1957; Larson 1971; Larson unpublished field notes; Etowah Specimen Record). It is very likely that the workshops are located in the village area and await excavation. Nevertheless, there is another possibility for the placement of workshops at the site. That can be deduced from a study of a south Florida site called Fort Center.

The Fort Center site is located on Fisheating Creek northwest of Lake Okeechobee in south Florida. The site is comprised of several mounds and a charnel pond. Mound A and the charnel pond respectively represent a habitation mound for burial technicians and an adjacent burial area. The tools used for making the wood and shell artifacts that adorned the charnel pond burial platform were recovered from Mound A (Sears 1982:96-103). It is possible that a loosely analogous situation obtains for the Etowah site. Kelly and Larson (1957:6) determined that Mound B had been used for habitation. It's possible that the artifacts buried at Etowah in Mound C were made on Mound B. Nevertheless, the most likely location for the workshops is in the village area.

The quantity of materials and tools recovered strongly suggest that artifact manufacture was occurring at the site. Evans' criterion is tentatively supported.

Tool Kits

The tools used to make the copper artifacts at the Etowah site are similar to the tools used during the Middle Woodland period at the Hopewell site. Hammerstones, anvil stones, scribers/gravers, pressure bossers, abraders, drills, fires, mandrels, and templates, were the tools identified by analysis. The use of sinking forms was identified for the Lake Jackson site, Florida, but not for the Etowah site. The tool kit used at the Etowah site

includes three specialized tools, pressure bossers, mandrels and templates. Pressure bossers were used to make the embossed plates and could have been made from bone, stone, or antler. The analysis of tool marks suggests that bone or antler embossing tools are the most likely. Tools similar to the ones suggested have been recovered at the site. The mandrels were probably made of wood, while a flexible hide (or perhaps turtle shell) is suggested for the templates. Mandrels, as in the Late Archaic, were used to make rolled tube beads. Templates were used to make similar symbol badges and headdresses. Unambiguous survival of the mandrels and templates can not be demonstrated, although their presence is indelibly fixed in the artifacts made with them. Artifacts made with a template are a coherent group, where as artifacts made without a template have numerous discrepancies. Evans' tool kit criterion is supported at the Etowah site.

Storage Facilities/Hoards

The Etowah site has not produced an isolated cache of metal artifacts, instead the metal artifacts were recovered from burials located in Mound C. At the present time it appears that Mound C is the only area that contains metal artifacts. Burials do not fit Evans' (1978) criterion and five burials at the Etowah site contained almost half of all the copper artifacts recovered at the site (Burial #s:38, 57, 67, 109, 148).

It is unlikely that storage facilities, caches, or hoards (other than the burials) will be found at the Etowah site. The inclusion of debris, unfinished artifacts, and finished artifacts in the burials suggests that ownership of the materials was not passed on to any surviving kin or group. It is possible that the artifacts were made on a piecemeal basis with storage being the responsibility of the individual owner. Group storage is still possible (Brown 1985), but the total removal and interment of a person's metal artifacts may render identification of storage areas impossible.

Resource Exploitation

Sources for the elite materials used at the Etowah site are identified in chapter two. It is clear that the Etowah site is located in a region where the resources are close at hand. Copper is obtained from an extension of the Ducktown copper deposit between twenty and sixty miles away (McCallie 1926:42; Hurst and Larson 1958). Regular exploitation is demonstrated by the quantity of materials recovered, and their placement within burials. The burials represent an ongoing process of acquisition, manufacture, and removal of the copper artifacts necessitating new acquisition; thus Evans' resource exploitation criterion is supported.

Exchange and Trade

Waring and Holder formulated the concept of the Southern Ceremonial Complex to account for similar motifs and materials that are recovered from geographically distant areas (Waring and Holder 1945). The influence of trade or exchange is primarily dealt with by trait lists that can not determine if actual artifacts are being exchanged, or if the motifs and designs are being used to manufacture similar artifacts at the separate sites.

Goad (1978:210, Figure 8) states that copper from the deposit exploited by Etowah is used to manufacture copper artifacts at a variety of sites in Georgia (e.g, Ocmulgee), Alabama (e.g., Moundville), and Florida (e.g, Mount Royal). Her analysis suggests the exchange or trade of raw materials, but does not shed light on the movement of specific finished artifacts.

Some artifacts made at the Etowah site are transported to other sites a considerable distance away. Stepped mace symbol badges recovered at Etowah and at the Lake Jackson site located near Tallahassee, Florida, are a case in point. These artifacts are made with the same template, and the sites are linked by a navigable river system. At the least, a minimal level of contact exists between the two sites. The Cemochechobee site is located upriver from the Lake Jackson site and also contains copper artifacts similar to the ones recovered at Etowah (Schnell,

Knight, and Schnell 1981). These artifacts have yet to be analyzed, but some may have been made with the same templates already identified (Knight personal communication, 1987). Vernon Knight suggests that some symbol badges at the Moundville site may also have been made at Etowah, based on scale photographs (Knight personal communication, 1987). Analysis of the metal artifacts from these sites is planned for the near future.

The vitality of the interaction or trade that the distribution of raw materials and artifacts represents can not be determined at the present. Nonetheless, Evans' trade or exchange criterion is supported at the Etowah site.

Differential Distributions

The Etowah site has not been fully excavated or tested; however, sufficient information exists for discussion. Copper artifacts have been recovered from only one of the six mounds originally located at the site. No copper was recovered from the testing of the village area east of Mound A (Kelly and Larson 1957). The copper artifacts appear to be confined to a single location, Mound C.

The burials at the Etowah site also demonstrate a differential distribution of copper artifacts. Village burials do not contain copper artifacts while five of the two hundred and forty-four burials in Mound C account for almost half of the copper artifacts recovered (Burial #s:38,

57, 67, 109, 148). Three of these burials were log tombs (Burial #s:38, 57, 109), one was a stone slab tomb (Burial# 148), and the last was a rectangular pit (Burial# 67); however, no direct correlation between mortuary form and the presence of elite materials can be made.

The duplication of certain materials, primarily copper, in some burials suggested to Larson (1971:65-67) that a costume with symbolic artifacts was being worn at the site. Distribution of the symbolic artifacts to individuals from different age groups (who were afforded similar mortuary treatment) further suggested that access to the materials was limited to certain groups by ascription (Larson 1971:67). The Etowah site supports Evans' criterion of differential distribution.

Discussion

The presence of specialists has been supported at the Hopewell and Etowah sites. In each case, four of the six criteria suggested by Evans were met, and one was tentatively supported. Compliance with a polythetic definition is demonstrated by a high level of "fit," not point for point similarity. The "fit" of these two sites is very good. The workshop and storage facility criteria were a problem since evidence for the metal artifact manufacture was present at both sites, but not a specific workshop or storage facility. This is not an insurmountable difficulty,

excavation in the village area at Etowah and testing of the enclosure at the Hopewell site should clarify the situation.

The Old Copper Industries did not meet the majority of criteria presented by Evans. It should be kept in mind that Evans' criteria is designed to identify unambiguous specialization. The Archaic data are too scanty for proper analysis at this time. This is not to say that metal specialists did not exist in the areas of the Old Copper Industries, but that it cannot be accurately determined. Vernon (1985:162) is of the opinion that specialists did exist and that the acquisition of raw materials and the manufacture of blanks may have been the job of inexperienced workers or apprentices. Vernon's attempt to extend the present understanding of Old Copper Industries artifacts is commendable. The artifacts are frequently underestimated, but there is no support for his interpretation of a manufacturing hierarchy. Apprentice is a particularly bad term to employ because of its unfortunate European connotations. Nonetheless, Vernon has made a valid point since the skills necessary to make the copper artifacts of the Old Copper Industries clearly require a great deal of skill and practice. Still, this could be obtained informally by observation and contact with those individuals actively involved. The motor skills employed in the manufacture of these artifacts are the same as those used to make stone, bone, and wood artifacts (Spier 1970).

Evans' criteria are a minimalist attempt to identify the unambiguous presence of specialists and specialization. It does not determine full-time or part-time status, or the degree of interaction between the specialist and the society to which he or she belongs. Muller (1984:494) points out that blind reliance on these criteria is not sufficient to illustrate the specific occurrence of specialization at the site being studied. His primary concern is the amount of time devoted to the specialty, this is addressed next.

The amount of time spent producing the metal artifacts at the Hopewell and Etowah sites is not easy to determine. The Hopewell and Etowah sites were occupied for relatively long periods of time, and the internal chronologies are not very good. A reasonable amount of metalwork could have been made in the allotted time at either site. Nevertheless, the deposition of copper artifacts was not uniform through time at either of these sites. At the Hopewell site the copper deposit and burial# 260, 261 represent two single episodes of deposition of metal artifacts beneath Mound 25. Similarly, the five major burials at the Etowah site are all from the same mantle and represent a short period of time.

The Hopewell copper deposit and burial# 260,261 contained more than two hundred and fifteen copper and iron artifacts. These artifacts included breastplates, celts, copper cut-outs, earspools, effigy plates, a headdress, and

raw materials. A replication of a simple copper cut-out using modern copper sheet (0.1 cm sheet reduced by stone hammering to 0.05 cm) and ancient tools (open wood fire, antler bosser, sandstone abrader, cobble hammerstone, paper template) took the author, who is a skilled craftsman, a week to make. There are enough copper cut-outs in the copper deposit of Mound 25 to keep a modern metalworker (using ancient tools) busy for a year. The sixty-six copper celts from burial# 260,261 could easily take two to three times longer. These materials represent a considerable time and labor on the part of several metalworkers. The use of templates and sinking forms for some of these artifacts suggest specialists who were involved in the manufacture of copper artifacts. Based on this analysis, it is possible that the Hopewell metalworkers who made these artifacts were full-time specialists.

Five burials (Burial#s:38, 57, 67, 109, 148) accounted for almost half of the copper artifacts recovered from the Etowah site. The burials included copper headdresses, axes, celts, breastplates, symbol badges, beads, and various copper clad wooden forms. The one hundred and fifteen copper artifacts from the Etowah burials were not made any faster than the copper artifacts at the Hopewell site. There is one difference, these artifacts clearly functioned in the living society, damage from use and subsequent repairs are common place. This is not to say

that the Hopewell copper artifacts were not a part of the living society, several artifacts definitely were. Nevertheless, the majority of the Hopewell copper artifacts can only be suggested as being part of the living society. The people who made the copper artifacts at the Etowah site were available at a later date to repair them. Although the actual number of metalworkers may have been quite small. Artifacts that functioned within the living society might be individually acquired over the owner's lifetime reducing the actual demand to a few artifacts per person per year. The quantity of artifacts interred with an elderly person would be significant, but represent a number of years of manufacture and acquisition. Nonetheless, the quantity of artifacts and repaired artifacts supports the possibility of full-time specialists at the Etowah site.

Summary

This chapter discusses the evidence for specialization in metalwork during the Archaic, Middle Woodland, and Mississippian time periods. The discussion is based on the analysis and interpretation of data from three metal artifact collections, the Old Copper Industries collection, the Hopewell collection, and the Etowah collection. Specialists are defined in this study as artisans who possesses unique knowledge of a skill and practice that skill, and specialization is defined as the collective actions of the individual specialist or

specialists. Evans' (1978) criteria for establishing the unambiguous presence of specialists at a site were applied to each of the three databases. The probable presence of metal specialists was demonstrated for the Hopewell and Etowah sites. A determination was made as to the approximate amount of time represented by several of the metal deposits at each site. Based on this analysis and the complexity of the artifacts, it was determined that full-time specialization may have been present at both sites.

CHAPTER SEVEN
SOCIAL COMPLEXITY AND METAL

Introduction

This chapter briefly examines the place of metal within the Late Archaic (Old Copper Industries), Middle Woodland (Hopewell site), and Mississippian (Etowah site) time periods. Data derived by this analysis is combined with earlier analyses to provide new insights and comparisons. A discussion and summary follows the last section.

Archaic Period

The Old Copper Industries are the material remains of distinct societies located in the Lake Superior region that are thought to share a similar level of social complexity (Quimby 1960; Fitting 1975; Griffin 1983:249; Penney 1985:28-36). Fishing, hunting, and gathering were the primary means of subsistence with seasonal migration to different areas to take advantage of specific resources (Quimby 1960; Fitting 1975; Penney 1985). Technically these groups were probably somewhere between a band and a tribe in organization (Braun and Plog 1982; Bender 1985). Bands are

usually considered to be egalitarian groups with informal decision making processes (Service 1975:60-61), where as tribes are social networks whose members may be ranked and are integrated by the cross cutting of panresidential institutions (Braun and Plog 1982:504). Band and tribe are used here as simple references without the teleological evolutionary perspective that has clothed them in the past.

Binford (1962) suggests that the majority of Old Copper Industries copper artifacts are sociotechnic items, artifacts that existed for social rather than religious or strictly functional reasons. He believes that the artifacts are acquired as social markers of achieved status. This status is not passed on and the artifacts are removed from the society by interment with the owner. Binford's argument is incorrect for the Old Copper Industries (Wittry 1951; McHugh 1973), although it still has proponents (Penney 1985:29; Vernon 1985). Nevertheless, Binford's suggestion is not invalid for artifacts recovered from distant areas, a number of which can fit a sociotechnic definition (Winters 1968).

The Old Copper Industries' use of copper to make utilitarian tools suggests that copper was viewed as a desirable but unremarkable resource. A material with intrinsic significance would not have been so frequently abused and lost. There is no evidence that the societies inhabiting the core of the copper producing regions attach

special significance to copper during this time period. Nevertheless, the significance attached to copper outside the primary copper producing region is different.

Copper is an exotic import to the outlying groups. Winters (1968) describes the shift in artifacts from utilitarian forms in the Great Lakes region to ornamental forms at the Indian Knoll site, located near the Green River in Kentucky, as probably tied to the scarcity and uniqueness of the material. An object's worth tends to increase proportionally to its scarcity and unfamiliarity, and inversely to its abundance and familiarity. The continuation of this situation beyond a period of first "contact" is complex and difficult to assess; however, copper did continue as a desirable acquisition for non-utilitarian purposes in outlying areas.

Bender (1985) suggests that the egalitarian nature of bands postulated for the Late Archaic of the eastern United States has been overrated, and that inequities are present in the reciprocal relationships of the period. She suggests that the formation of tribes are tied to the advantages and disadvantages of inequities arising from reciprocity (Bender 1985:54-55). The formal or informal institutionalization of the inequities among different groups may take many forms (e.g., material, social, and ideological). Controlling access to socially valued material items is one way of providing a visual marker of

the relationship and asserting dominance (Bender 1985:55). Copper is only one of several materials that are apparently used in this way (Winters 1968; Streuver and Houart 1972; Penney 1985). The ornamental importance of copper (and other contemporaneous materials) appears to increase over time. Nevertheless, copper never entirely ceases to be used for tool manufacture in the Lake Superior region (Griffin 1961).

Middle Woodland Period

The Hopewell site and the Ohio Hopewell culture represent something of an enigma at the present time. Monumental architecture, burials, and "elite" materials have been investigated, but there is little concrete information or agreement concerning patterns of habitation, subsistence, or social level (Brose and Greber 1979; Greber 1979; Griffin 1979; Brose 1985). The Hopewell site represents special usage over time by several different groups, perhaps lineages from unspecified outlying areas (Prufer 1964; Griffin 1979; Brose 1985). Comparative data about the groups that used the site are lacking, making it difficult to integrate the copper artifacts with the groups. Nonetheless, some general points can be made.

The Hopewell Interaction Sphere formulated by Caldwell (1964) and expanded by Streuver and Houart (1972) defines the copper artifacts as one of several material markers of reciprocity and communication. The diversity of

the groups that differentially exhibit "Hopewellian" features and influence suggests ideological overlay or trade partnerships to some researchers (Streuver and Houart 1972; Seemans 1979). Nevertheless, the vitality, extent, and content of the suggested interaction can be seriously questioned (Griffin 1979; Seemans 1979; Brose 1985). This study suggests that the importance of the Hopewell Interaction Sphere is probably overrated. A recent article by N'omi Greber (1979) illustrates this point.

Greber's analyses of Seip Mound 1, Raymond Ater Mound, and the Turner Burial Place suggest a wide range of social structure complexity for Ohio Hopewell (Greber 1979:55-57). She states that Seip Mound 1 is used by three main groups that had their own place of burial within the mound (Greber 1979:45). These groups have similar distributions of marine shell containers, shell beads, pearls, flint blades, and non-utilitarian worked animal teeth and bones, but copper artifacts are differentially distributed among the groups' burials (Greber 19079:42). Her analysis shows that group three does not have any copper artifacts, where as group one has the greatest occurrence of copper plates and group two has the most earspools (Greber 1979:42). She interprets the data to show ascribed social ranking within three distinct social groups (Greber 1979:45).

The Raymond Ater Mound differs from the Seip Mound on a number of important points. A single internally ranked group is present at the Raymond Ater Mound, and Greber (1979:50-51) believes that the copper plates, earspools, marine shell containers, pearls, and non-utilitarian worked animal bone are used to identify significant individuals rather than social groups (Greber 1979:50). Greber (1979:50-51) interprets the lack of infants and children interred in the mound and the association of non-perishable grave goods with older adults as indicating an age hierarchy. The inclusion of headdresses and panpipes in the burials identify ritual activities that separate males and females; twice as many males as females are involved in these activities (Greber 1979:50). Nevertheless, the main social group contains males and females with no overall differences in social ranking (Greber 1979:50). Based on these data, Greber (1979:51) states that the society at the Raymond Ater Mound site is less complex, although it exhibits a relatively strong age hierarchy and sex differentiation.

Greber's (1979:55) analysis of the Turner Burial Place puts it between the two preceding sites in terms of social complexity. She identifies two groups at the site based on grave orientation (e.g. north-south, east-west; Greber 1979:54). These groups contain some ranking that can be distinguished primarily by head orientation, north in the

north-south group, and east in the east-west group (Greber 1979:54). Possible kin group clusters occur within both orientations. Nevertheless, the groups are not in a hierarchical relationship to each other and appear to be nearly equal in ranking (Greber 1979:54, 55).

Greber (1979:55-57) concludes that the differences in Ohio Hopewell social structure and organization can vary the social context and function of morphologically similar artifacts. She warns that patterns of exchange are tied to social relationships and that a given society may simultaneously support different exchange mechanisms for specific artifacts (Greber 1979:57). Greber's analysis demonstrates the lack of a unified mechanism of exchange, an overarching ideology or social function suggested by some proponents of the Hopewell Interaction Sphere (c.f.,Streuver and Houart 1972).

The majority of the artifacts identified as being "Hopewellian" are made at or near the major centers where they were found and stayed there (Streuver and Houart 1972; Seemans 1979). Copper artifacts from the Hopewell site appear to have behaved in the same manner. Few copper forms from the Hopewell site are shared with other "Hopewellian" sites and the quantity of the shared artifacts is small (Seemans 1979; Greber personal communication, 1987; Griffin personal communication, 1987). The copper artifacts are primarily being used inside the societies, not outside; and

for social rather than utilitarian purposes. The only metal artifacts from the Hopewell site that might have had utilitarian functions are the copper celts and axes, four iron chisels hafted in antler, a few awls, some buttons, and an iron drill. Nevertheless, the axes and celts were never used and the chisels are corroded making it impossible to tell. The copper clad stone buttons are structurally weak suggesting only special usage, leaving a few awls and an iron drill found inside a pearl (Moorehead 1922:146) to represent functional metal tools at the site.

The function of the Hopewell collection copper artifacts is difficult to determine. Greber (1979:) states that the use of spatial areas, burial forms, and artifact distributions are different at the Hopewell site from those she identified at Seip, Raymond Ater, and Turner Burial Place. Nevertheless, three suggestions are made about the function of the copper artifacts at the Hopewell site and include: honoring or affirming the status of the dead by burying them with their social or ceremonial possessions, interment gifts collected from kin or obligated individuals, and veneration or acknowledgement of spirits, forces, or individuals identified with the site. A number of the burial offerings are probably personal possessions (e.g., some earspools, beads, headdresses) representing social or ceremonial status; however, others may represent voluntary or obligatory gifts (e.g., the sixty-six celts from Burial#

260,1). Voluntary or obligatory gifts would emphasize cohesion, perhaps raise the status of the giver through a public gesture, or free the individual of incurred "debt." The one hundred and twenty copper plates recovered from the copper deposit in Mound 25 may have been an offering placed there for purposes of propitiation or acknowledgement.

The metal serpent head cut-out, bracelets, brooches, beads, headdresses, and some breastplates and earspools were used prior to interment. These artifacts probably indicated social status or ideology (Bender 1985; Binford 1962; Brose 1979; Greber 1979). Nevertheless, actual use of the rest of the artifacts cannot be determined with certainty due to corrosion or subsequent cleaning.

The presence of specialists at the Hopewell site has already been discussed in chapter six. The tools, techniques, and quantities of finished materials all suggest specialists and may represent full-time involvement. Full-time or intensive specialization is not easily supported and places strain on the society (Muller 1984). The groups using the Hopewell site were apparently able to do this, although the manner in which it was done is presently unknown.

Mississippian Period

The use of copper and other elite materials by Mississippian societies has been recently discussed by Brown (1985). Etowah was one of several chiefdoms located in the

Southeast. Chiefdoms are societies with centralized control over domestic economy that is exercised through an ascribed hereditary office (Sahlins 1972:132-148). The use of this term is based on the historic accounts of similar Indian societies from the end of the Mississippian period (Larson 1971; Brown 1985:97), and is provided as a point of reference without evolutionary implications. The copper artifacts from the Etowah site were made for both internal and external consumption.

The internal use of copper at Etowah is for social demarcation (Larson 1971; Brown 1985). Headdresses, breastplates, earspools, symbol badges, gorgets, raptor/warrior being plates, and axes are differentially distributed among the burials in Mound C. The artifacts are part of the social life of the prehistoric people and show signs of wear and subsequent repair. Functional copper axes are hafted in carved wood, but are not used as tools. Instead, the copper axes and identical stone monolithic axes are symbolic markers of status (Brown 1985).

Brown (1985:102-108) suggests that Mississippian sites have two competing social groups that are expressed as public cults. The two cults are an earth or fertility cult and an ancestor or political cult (Brown 1985:104). The first cult is an open group directly accessible to any member of the society, where as the second is a hereditary cult intent on legitimizing chiefly authority. A third cult

may bridge the gap between the first two and is a warrior cult (Brown 1985:129). The warrior cult is under the control of the elite and allows the masses to achieve status and recognition (Brown 1985:129). Each of the three groups manipulates material artifacts to mark their existence and relative strengths.

The fertility cult is represented at Mississippian sites by female statues (e.g., Birger figurine) and perhaps by whorls, scrolls, and undulating abstract motifs (Brown 1985:123-129; Prentice 1986). Etowah is a little different from other sites in that the female fertility figures are apparently accorded equal status with the male ancestor statues and kept in the same location, the ancestor temple or shrine (Brown 1985:105). Brown (1985:104-105) states that the temple or shrine is the seat of the ancestor cult and normally contains a single male statue. A number of the burials in Mound C are female and accorded complex interment with elite materials, primarily of shell and pearls (Larson 1971). Brown (1985) suggests that elite materials found with females are burial gifts; however, it is possible that at the Etowah site some females interred in Mound C had grave goods that identify social status. If this is the case, then the placement of statue couples in the ancestor shrines takes on a new meaning. Unfortunately, the present burial data are incapable of supporting intensive analysis (Larson 1971). Careful reanalysis of the burial materials

should provide the necessary data base for testing the hypothesis.

The ancestor cults are represented at Mississippian sites by skull and bone motifs, male statues, and temples or shrines that also acted as charnel houses (Brown 1985:104-108). The temple structure is located on a mound and housed, the venerated dead, ancestor statues, axes, celts, headdresses, plates, and other sumptuary materials (Swanton 1911, 1946; Brown 1985:104). The temple structure is the locus of sacred power from relics, earthly wealth, and in some cases coercive action (Brown 1985:104). This action came from the use of armaments that are stored in the structures by some groups (e.g., Natchez-Taensa, Bayogula, Creek; Swanton 1911). A series of such structures is associated with Mound C at Etowah, one for each of the mound mantles (Larson 1971).

The copper artifacts housed in some of these structures, and perhaps at Etowah, represent chiefly authority, symbolic interaction of the power residing in the three cults, and tools for economic development/foreign alliances (Swanton 1911, 1946; Peebles 1971; Brown 1976, 1985:104-15). Chiefly authority may have been identified by several iconographic materials including sun circles, sedan chairs or their representation, raptor beings, and chunky players and stones (Brown 1985:115-123). The costumes of the raptor beings as depicted on the gorgets and plates

include plate headdresses, maces, beads, a columella forelock bead, and aprons (Hamilton, Hamilton, and Chapman 1974). Several of the burials in Mound C contain portions of this costume, and one contains practically all of it (Larson 1971:62). Raptoral and weaponry designs may also be tied to the warrior cult.

The warrior cult appears to be represented by symbol badges in the shape of weaponry or feathers, monolithic axes, maces, and headdresses incorporating weapon motifs (maces, perhaps bilobed arrows; Brown 1985:114-115). A number of the symbol badges from Etowah may contain integrative motifs, such as feather badges with undulating lines or whorls, plain mace badges contrasted with stepped badges with a central cross, and raptor talon badges with circled crosses (sun circle/four wind design?).

External uses of the copper may include exchange of materials to finalize alliances, or gifts to stimulate trade (Swanton 1946; Brown 1985). The stepped mace symbol badges housed in the Lake Jackson collection that are originally from Etowah probably represent this situation. It is probable that Gulf coast materials passed inland from the Lake Jackson site to other sites including Etowah. The choice of stepped mace symbol badges as trade items with their combined motifs is interesting and merits further research.

Discussion

The previous section briefly discusses the use of copper by three different societies, the Old Copper Industries, the Hopewell site, and the Etowah site. Copper artifacts shift from utilitarian to social/ornamental forms over time, although outlying societies during the Late Archaic period already use copper for ornamental purposes. By the Middle Woodland period copper artifacts are one of several markers of social status/role for a number of copper using societies in the eastern United States. The copper artifacts that are analyzed in this study are more easily tied to internal rather than external societal uses, although limited external uses exist.

Mississippian chiefly societies demonstrate the power and use of internally manipulated elite goods. The support or reaffirmation of authority given by manipulating elite materials was not lost upon other less complex groups who were in contact with the chiefdoms. The rapid assimilation of Spanish metal by metal poor societies may represent an attempt to redress a perceived inequity with their neighbors. Study of this phenomena may provide insight into the workings of historic chiefdoms and the function of metal within chiefly societies.

Florida has no deposits of metal accessible to the prehistoric peoples who lived there. All metal was acquired through trade with groups outside the area (Milanich and

Fairbanks 1980; Leader 1985). The earliest metal in Florida is associated with the Yent complex (Milanich and Fairbanks 1980). The Yent complex belongs to the Deptford period and is defined by Sears (1962) from information derived from the Crystal River, Yent, and Pierce sites. Copper panpipes, rectangular plates, and earspools were all recovered from the Crystal River site located in Citrus County (Sears 1962; Goad 1978, Seemans 1979; Milanich and Fairbanks 1980). Goad (1978:175-181) believes that the complex supplied shells (e.g., Busycon sp.) that were exchanged for exotic materials including finished copper artifacts. Her analysis suggests that both Lake Superior copper and southeastern copper sources were used to make the copper artifacts recovered from north Florida (Goad 1978:186). There is no evidence that any copper artifacts were produced in Florida during this time period. Finished copper artifacts are traded into Florida, not raw materials (Milanich personal communication, 1988). This situation continues until the contact period.

The Safety Harbor complex is located in the center of the peninsular gulf coast and dates from before A.D. 1400 to the European contact (Milanich and Fairbanks 1980:204). Safety Harbor is associated with the historic Tocobaga Indians who were described by the Spanish during their explorations (Bullen 1978:50). A number of historic Indian groups, including the Calusa, are located further south, but are not in contact with the metal artifact producing

societies of Georgia during this time period. The Safety Harbor complex probably marks the southernmost prehistoric extent of trade in metal, although this trade was minimal by contact times.

The first record of a Spanish expedition to Florida occurs in 1513 when Juan Ponce de Leon is given a grant to colonize a mythical island called Bimini. Instead he put ashore on the Gulf coast side of Florida where an Indian group, probably the Calusa, met him (Smith and Gottlob 1979:1-2). Ponce de Leon was not the first Spaniard to travel to Florida, since at least one of the Indians he met spoke Spanish (Smith and Gottlob 1979:2). Native decimation by disease and abuse in the islands prompted the Spanish to venture out in slaving expeditions, the first recorded slave raid in Florida is 1520 (Hanke 1949:19).

Seven Spanish expeditions for exploration or colonization occur between the years 1513 and 1539-40. Two of the expeditions penetrate the interior of Florida, the Narvaez expedition (1528), and the DeSoto expedition (1539-40). One result of these expeditions is the depositing of large quantities of European materials in the hands of the Florida Indians. Spanish shipwrecks along the southern coasts of Florida during the period 1500-1550 provide the south Florida Indians with large quantities of metal (Smith and Gottlob 1978:4, 12).

The Calusa are a historic Indian group in south Florida whose boundaries extended north to Charlotte Harbor and south to the Florida Keys (Lewis 1978:19). Their northern boundary coincided with the Tocobaga (Milanich and Fairbanks 1980). The Calusa energetically acquired large quantities of gold, silver, brass, bronze and copper from the Spanish Shipwrecks (Lewis 1978:23). It is possible that the Calusa had already learned to "harvest" metal from shipwrecks prior to Ponce de Leon's first voyage in 1513 (Lewis 1978:21).

The Spanish explorers found the Calusa to be politically ambitious and expansionist, and in conflict with the Tocobaga to the north and the Saturiwa to the northeast (Lewis 1978:26; Marquardt 1988). The Calusa consolidated there position in south Florida by allying themselves to the Tequesta by blood. Spanish descriptions of the social organization of the Calusa and Tequesta suggest complex chiefdoms that were new to the scene (Swanton 1946; Lewis 1978; Marquardt 1988). The metal and other elite materials recovered from the shipwrecks were incorporated into the society, and were reworked into culturally relevant forms.

Spanish accounts state that the metal belonged to the chief who stored it in a central location; and sent agents to collect metal from wrecks and tributary groups (Lewis 1978). The Calusa were not metalworkers before the contact period, but they were talented artisans in shell,

bone, and wood (Gililand 1975; Schwehm 1983; Leader 1985). The Calusa used skills mastered in these other media to produce metal artifacts that copied shell, bone, or wood artifacts. These metal artifacts are distinguished by their non-native metals, their distinct tool marks, their relative simplicity compared to the metal artifacts of North Florida or Georgia, and their general lack of finish (Leader 1985, 1986). Unmodified European or South American metal artifacts are often found with the reworked metal artifacts. The term, South Florida Metal Complex, is introduced to distinguish this metal assemblage from other southeastern forms.

The Fort Center site located on Fisheating creek northwest of Lake Okeechobee provides a reference collection for the South Florida Metal Complex. The extensive metalwork from this site is curated at the Florida State Museum, Gainesville. The most common artifact at the Fort Center site are metal beads that take a number of different forms, disk beads, rolled beads, rod beads, barrel beads, round beads, and lump beads (Leader 1985). The disk beads, rod beads, barrel beads, and round beads are all based on shell beads of identical form and technique of manufacture (Leader 1985:41-47. The lump beads were made from melted metal fragments with random shapes. Rolled tube beads are present at Fort Center, although they are made from European materials.

Copper, silver, brass, and gold disks and gorgets (square or rectangular) were also found at the site, and resemble wood and shell artifacts of similar manufacture. The DeBry wood cuts show the wearing of similar ornaments (DeBry 1976). Some of the disks are engraved by assiduous grinding with stone tools (FSM FC ACC.#s: 70, 72); however, the artisan was unfamiliar with metal and ground the design too deeply causing the pieces to fail (Leader 1985:49-50). This lack of metalworking knowledge is common within the South Florida Metal Complex.

A silver hemisphere (FSM FC ACC.# 36) is the only unmodified European artifact at the site and represents a possible pommel. Several South American gold artifacts were found at the site, five gold bird effigy beads from Colombia, and a gold Inkan jaguar. These artifacts were carried by the Spaniards from South America to Florida and acquired by the south Florida Indians through trade or misadventure. The other sites in south Florida that exhibit the South Florida Metal Complex also contain these curiosities (Leader 1986). The parameters of this complex follow the boundaries of the historic Calusa and overlap some areas of the Safety Harbor complex.

Summary

This chapter briefly examined the place of metal within the Late Archaic (Old Copper Industries), Middle Woodland (Hopewell site), and Mississippian (Etowah site)

time periods. Data from previous analyses were combined with the present study to re-evaluate the use and role of metal artifacts.

The Old Copper Industries of the Lake Superior region used metal artifacts as utilitarian tools. The suggestion that the copper artifacts were primarily used as markers of status (Binford 1962; Penney 1985) cannot be supported for the Old Copper Industries, although outlying groups did use ornamental copper artifacts (Winters 1968).

The prehistoric people(s) that built the Hopewell site used metal artifacts for internal social purposes. The variety of expression subsumed by the Hopewell culture makes it difficult to determine specific uses of artifacts pan regionally (Greber 1979), similar artifacts have a variety of meanings within a limited geographic area. Nonetheless, three general uses of metal artifacts that resulted in their interment at the Hopewell site may included, honoring or affirming the status of the dead by burying them with their social or ceremonial possessions, interment gifts from kin or obligated individuals, and veneration or acknowledgement of spirits, forces, or individuals identified with the site. These actions would have emphasized social cohesion, garnered or reaffirmed status, and acknowledged or relieved debt.

The copper artifacts from the Etowah site are used both inside and outside the society. The internal use of

copper at Etowah is for social demarcation (Larson 1971; Brown 1985). Brown (1985:102-108) suggests that Mississippian sites have two competing social groups which were expressed as public cults. The two cults are an earth or fertility cult and an ancestor or political cult (Brown 1985:104). The first cult is an open group directly accessible to any member of the society, while the second is a hereditary cult intent on legitimizing chiefly authority. A third cult may bridge the gap between the first two and is a warrior cult (Brown 1985:129). The warrior cult is under the control of the elite and allows the masses to achieve status and recognition (Brown 1985:129). Each group manipulates material artifacts to mark their existence and relative strengths.

External uses of the copper may include exchange of materials to finalize alliances, or gifts to stimulate trade (Swanton 1946; Brown 1985). The stepped mace symbol badges housed in the Lake Jackson collection probably represent this situation.

CHAPTER EIGHT
SUMMARY AND CONCLUSIONS

Purpose of this study has been to define the level of copper technology in the eastern United States, clarify some misunderstandings concerning Indian metalworking technology, identify technological continuities, and address the issue of specialization as it pertains to copper during the Late Archaic, Middle Woodland, and Mississippian time periods. Three copper collections were analyzed to provide this information, the Old Copper Industries of the Great Lakes region (Archaic), the Hopewell site of the Ohio Valley (Middle Woodland), and the Etowah site of north Georgia (Mississippian).

A four-fold approach based on the re-evaluation of earlier analyses, basic technometric analysis, xeroradiography, and experimental archaeology was used to elucidate the research goals. A total of 1,373 metal artifacts from the three collections were analyzed. This analysis provided basic fabrication data including sources of raw materials, place of manufacture, tools, manufacturing techniques, and artifact use and repair.

The Old Copper Industries copper artifacts were primarily functional tools and not ornamental forms. Technical proficiency exhibited by these artifacts is advanced, although the basic techniques are less complex than those of later times. Some of the artifacts represent ingenious solutions to structural problems arising during use (e.g., triangular socketed spear points), and demonstrate an application of direct experience to the design of the artifact. It is very likely that specialists in metal did exist in the region during the Late Archaic period; however, there is insufficient data at present to define the scope and form that this specialization took.

Copper artifacts in the Hopewell collection were ornamental in form, although a few utilitarian metal artifacts were recovered (e.g., iron drill, four iron chisels, copper awls). Metalwork from the Hopewell site is probably the finest representation of prehistoric Indian metalwork in the United States. Artisans had mastered the basic techniques used by the Old Copper Industries and had added several specialized tools and techniques (e.g., templates, sinking forms). Copper geometric cut-outs and effigy plates demonstrate the Hopewell ability to portray abstract forms in positive and negative space, and realistic three dimensional copies of the natural world. The exchange in material artifacts, including copper artifacts, from the Hopewell site to regions far distant has been overstated.

Any exchange that took place was distinctly one-sided, raw materials were actively acquired, as the quantity of copper artifacts and raw materials demonstrate; however, the copper artifacts were made at or near the site and the majority never left.

Metal specialists were involved with the manufacture of copper artifacts at the Hopewell site. Quantity and complexity of the materials found in single deposits, coupled with the quantity of materials recovered from the site, suggest that metalworking was a full-time specialty. However, it cannot be determined if the full-time specialization extends for the entire span of site's occupation or for the time period contemporaneous with the major deposits in Mound 25. Full-time specialization is a taxing addition to any society. Stress relieving mechanisms used at the Hopewell site have not been delineated. There is insufficient information concerning habitation, social organization, and subsistence to properly discuss the place and role of metal within the society.

The Etowah collection is similar to the Hopewell collection in terms of artifact complexity and fabrication techniques. Etowah elite artifacts, including copper artifacts, were ornamental and acted as markers of social status and wealth. Fabrication techniques used at the Etowah site included the earlier forms used by the Hopewell, but show a shift towards thinner metal sheet artifacts and

the copper cladding of stone and wood artifacts. These techniques were known and used at the Hopewell site, but were not used as often. This shift may have resulted from several factors including the relative scarcity of metal derived from southeastern sources, or the increased use of large copper ornaments for ceremonial and everyday apparel.

Brown (1985) suggests that there were three public cults present in many of the chiefly Mississippian societies, including Etowah. These cults had specific motifs and designs that were exhibited in the elite material artifacts, and often combined to demonstrate social cohesion or dominance. Accuracy of his interpretation needs to be further tested, but provides insight into the specific forms and depositional organization of the copper artifacts from the Etowah site.

Metal specialists were present at the Etowah site and engaged in on-site manufacture and repair of the artifacts. Possession of the raw materials appears to have been in the hands of the elite since the raw materials, unfinished artifacts, finished artifacts, and repaired artifacts were recovered from elite burials. However, the tools from the site were recovered from village fill used to construct the mound, suggesting that the metalworkers resided in the village area.

Exchange or trade of copper artifacts produced at Etowah was demonstrated by the recovery of a number of

stepped mace symbol badges at the Lake Jackson site, Florida. Use of templates by the metalworkers at Etowah should make it relatively easy to identify other materials traded to outlying areas in the southeast. Sites in Georgia, Alabama, and Florida, and other areas may have had limited involvement. It should be made clear that the vitality of this exchange may not be very great and was apparently limited to small finished artifacts.

This study is preliminary, a full understanding of the use of metal by the prehistoric peoples of the eastern United States requires additional analysis of collections from each of the time periods, and further data concerning the variation in social organization exhibited by specific metalworking societies. Data derived from the collections provide insight into specific metalworking societies, but does not necessarily cover the range in variation of other societies of the period. Care should be exercised not to over-generalize about the metalworking of any time period. Technology is a dynamic part of society and varies accordingly.

As a final statement along these lines, it is only necessary to point to the use of metal in South America. Although the Old Copper Industries precede the earliest South American metalworking society by a thousand years, South American metalwork became more complex in its use of metals and techniques (Easby 1966; Grossman 1972; Lechtman

1976, 1979). All the techniques described in the preceding chapters were used by pre-European contact South American metalworkers. To this base was added, alloying (e.g., arsenical and tin bronze), smelting (oxide and sulfide ores), reduction gilding (tumbaga, the selective removal of one metal in a two or three metal alloy), lost wax casting, and soldering (Lothrop 1951; Easby 1966; Lechtman 1976, 1979; Moseley and Feldman 1978). These additions were not the result of an undefined urge for advancement, but resulted from a complex interplay of the individual societies and their technologies.

Development of new non-destructive quantitative analytical techniques sharpens and expands the basic fabrication data and suggests new avenues for research. This is a desirable and expected part of research. Nevertheless, the present study does refine some areas of the understanding of prehistoric Indian metalwork and metalworking specialists in the eastern United States, and suggests areas for future work.

Future work needs to be concentrated on several areas. Technometric data need to be gathered and compared from synchronic and asynchronic collections. This should be a primary goal among archaeologists. We are behind in this work and it needs to be accomplished. A wealth of information exists that has yet to be adequately integrated by the discipline; before it corrodes to dust. Trace

element analysis, furthered by Goad (1978), is needed to pinpoint specific source areas within metal-bearing regions. Our present data are still too narrow (despite several significant advances in research) to support accurate interpretations of acquisition, trade, and social control as it relates to prehistoric elite artifact manufacture. A greater variety of artifacts, sites, and time periods need to be included in these trace element analyses for them to have real meaning. Ohio Hopewell habitation patterns need to be delineated, and contemporary living areas with the major earthwork enclosures need to be identified and tested. Until this is done there will be insufficient data to accurately assess Hopewell societies.

Each of the areas for future work requires a discipline wide effort to achieve a satisfactory conclusion in the short term. Although this is not very likely, any well defined analysis of a portion of these areas will advance archaeological understanding. When these tasks are eventually accomplished the technological study of prehistoric Indian metalworking should be on a firm and productive footing.

APPENDIX A
ARCHAIC COPPER ARTIFACTS

APPENDIX A

ARCHAIC COPPER ARTIFACTS TABLE #1: PROVENIENCE

FMNH #	DESCRIPTION	LOCATION OF FIND
52001	copper spear point	Taycheda, Fon du Lac Co. Wisconsin
52006	copper spear point (socketted)	Washington Co., Wisconsin
52007	copper knife	Cedar Lake, West Bend, Washington Co., Wisconsin
52010	copper implement	N.E. of West Bend, Washington Co., Wisconsin
52011	copper spear point (socketted)	Westcot Farm, Boltonville, Washington Co., Wisconsin
52013	copper spear point (socketted)	Richfield, Washington Co., Wisconsin
52015	copper spear point	West Bend, Washington Co., Wisconsin
52016	copper spear point (tanged)	Herman, Washington Co., Wisconsin
52025	copper spear point (socketted)	Holy Hill, Richfield, Washington Co., Wisconsin
52028	copper spear point (socketted)	Government Hill, Waukesha Co., Wisconsin
52029	copper spear point (rattail)	Boltonville, Washington Co., Wisconsin
52030	copper spear point (socketted)	Hartsman Farm, Farmington Washington Co., Wisconsin
52033	copper spear point (socketted)	Monches, Waukesha Co., Wisconsin
52036	copper spear point	Hartford, Washington Co., Wisconsin
52037	copper spear point (tanged)	Hartford, Washington Co., Wisconsin
52039	copper spear point	Warner's Landing, Vernon Co., Wisconsin
52041	copper spear point (socketted)	Huilsburgh, Washington Co., Wisconsin
52042	copper spear point (socketted)	Hartford, Washington Co., Wisconsin
52044	copper spear point (tanged)	McHenry Farm, Myra, Washington Co., Wisconsin
52045	copper spear point (tanged)	Kline's Farm, Farmington, Washington Co., Wisconsin
52049	copper knife fragment	Weikert's Farm, Silver Lk, Washington Co., Wisconsin

APPENDIX A

ARCHAIC COPPER ARTIFACTS TABLE #1: PROVENIENCE (continued)

FMNH #	DESCRIPTION	LOCATION OF FIND
52052	copper spear point (tanged)	Boltonville, Washington Co., Wisconsin
52059	copper spear point	North East of West Bend, Washington Co., Wisconsin
52060	copper spear point (socketted)	North East of West Bend, Washington Co., Wisconsin
52061	copper spear point (socketted)	Hartford, Washington Co., Wisconsin.
52063	copper spear point	Near Iran Ridge, Dodge Co., Wisconsin.
52065	copper spear point (socketted)	Westcot Farm, Boltonville, Washington Co., Wisconsin.
52068	copper spear point (socketted)	Holy Hill, Richfield, Washington Co., Wisconsin.
52069	copper spear point (socketted)	North East of West Bend, Washington Co., Wisconsin.
52071	copper spear point (socketted)	West Bend, Washington Co., Wisconsin.
52073	copper spear point (socketted)	Boothe's Farm, Lisbon, Waukesha Co., Wisconsin.
52074	copper knife (socketted)	Bank of Pewukee Lk, Waukesha Co., Wisconsin.
52076-1	copper spear point (socketted)	Westcot Farm, Boltonville, Washington Co., Wisconsin.
52076-2	copper spear point (socketted)	Westcot Farm, Boltonville, Washington Co., Wisconsin.
52077	copper knife	Indian Hills, Boltonville, Washington Co., Wisconsin.
52097	copper spear point (socketted)	Mapleton, Oconomowoc, Waukesha Co., Wisconsin.
52099	copper fragment	Farmington, Washington Co., Wisconsin.
52102	copper spear point (socketted)	Dousman, Waukesha Co., Wisconsin.
52106	copper spear point (socketted)	Jefferson, Jefferson Co., Wisconsin.
52108	copper spear point (socketted)	Port Washington, Ozoukee Co., Wisconsin.
52115	copper knife	Presque Dale, North of Marquette, Michigan.
52123	copper knife (socketted)	Dueckelow's Fam, Ashippen, Dodge Co., Wisconsin.
52132	copper spear point (socketted)	Hebron, Jefferson Co., Wisconsin.
52138	copper spear point (perforated)	Gibson, Manitowoc Co., Wisconsin.

APPENDIX A

ARCHAIC COPPER ARTIFACTS TABLE #1: PROVENIENCE (continued)

FMNH #	DESCRIPTION	LOCATION OF FIND
52141	copper spear point (socketted)	Varney's Farm, Farmington, Washington Co., Wisconsin.
52146	copper spear point (socketted)	Mapleton, Oconomowoc, Waukesha Co., Wisconsin.
52161	copper spear point	Omro, Winnebago Co., Wisconsin.
52167	copper chisel (part of cache)	1 mile S. of Ft Brady, Greenaugh Ranch, Sault Ste Marie, Michigan.
52168	copper celt (part of cache)	Same as above.
52170	copper celt (part of cache)	Same as above.
52171	copper celt (part of cache)	Same as above.
52172	copper celt (part of cache)	Same as above.
52174-1	copper celt (part of cache)	Same as above.
52174-2	copper celt (mis-numbered)	Unknown.
52175	copper celt (part of cache)	1 mile S. of Ft Brady, Greenaugh Ranch, Sault Ste Marie, Michigan
52178	copper implement (part of cache)	Same as above.
52179	copper implement (part of cache)	Same as above.
52180	copper implement (part of cache)	Same as above.
52181	copper implement (part of cache)	Same as above.
52183	copper implement (part of cache)	Same as above.
52184	copper implement (part of cache)	Same as above.
52185	copper implement (part of cache)	Same as above.
52186	copper implement (part of cache)	Same as above.
52187	copper implement (part of cache)	Same as above.
52188	copper implement (part of cache)	Same as above.
52189	copper implement (part of cache)	Same as above.

APPENDIX A

ARCHAIC COPPER ARTIFACTS TABLE #1: PROVENIENCE (continued)

FMNH #	DESCRIPTION	LOCATION OF FIND
52190	copper implement (part of cache)	Same as above.
52191	copper implement (part of cache)	Same as above.
52192	copper implement (part of cache)	Same as above.
52193	copper implement (part of cache)	Same as above.
52199	copper celt (part of cache)	Same as above.
52202	copper celt (part of cache)	1mile S. of Ft Brady, Greenaugh Ranch, Sault Ste Marie, Michigan.
52203	copper celt (part of cache)	Same as above.
52204	copper celt (part of cache)	Same as above.
52205	copper implement (part of cache)	Same as above.
52206	copper celt (part of cache)	Same as above.
52207	copper implement (part of cache)	Same as above.
52223	copper spear point	Pine River, Charlevoix or Petosky, Michigan.
52229	copper axe (socketted)	New Holstein, Calumet Co., Wisconsin.
52233	copper celt	Dewary's Mill, Acadia, Trempeleau, Wisconsin.
52235	copper axe (socketted)	DelCarver Farm, North of New London, Waupaca Co., Wisconsin.
52240	copper pin	Michigan.
52241	copper pin	Michigan.
52259	copper knife	Portage entry near light-house, Lake Superior Ship Canal, Michigan.
52260	copper knife	Same as above.
52262	copper knife	Same as above.
52266	copper celt	Ashland, Ashland Co., Wisconsin.
52277	copper bar	Midden on bank of the Oconto R., Oconto, Oconto Co., Wisconsin.
52283	copper spear point	Escanaba-deltaleo, Michigan.

APPENDIX A
ARCHAIC COPPER ARTIFACTS TABLE #1: PROVENIENCE (continued)

FMNH #	DESCRIPTION	LOCATION OF FIND
52294	copper implement	DelCarver farm, North of New London, Waupaca Co., Wisconsin.
52296	copper implement	Lime Kiln, Hortonville, Ontagamie Co., Wisconsin.
52340	copper celt	Lake Superior Ship Canal, Haughton Co., Michigan.
52342	copper bar	Same as above.
52343	copper implement	Same as above.
52344	copper bar fragment	Portage entry, Lake Superior Ship Canal, Michigan.
52347	copper fragment	Lake Superior Ship Canal, Haughton Co., Michigan.
52359	rolled tube beads	Wisconsin.
52610	copper spear point (tanged)	Auburn, Fond du Lac Co., Wisconsin.
52617	copper spear point (socketted	Town of Edon, Fond du Lac Co., Wisconsin.
68003	copper semi-circle	Prairie du Chien, Crawford Co., Wisconsin.
68005	copper blank	Doty's Island, Neenah, Winnebago Co., Wisconsin.
68006-1	copper nugget	Near Neenah, Winnebago Co., Wisconsin.
68006-2	copper nugget	Same as above.
68011	copper spear point (tanged)	Winneconne, Winnebago Co., Wisconsin.
68012	copper spear point	Fruitport, Muskegon Co., Michigan.
68013	copper spear point (socketted)	Hancock, Houghton Co., Michigan.
68018	copper spear point (socketted)	Saukville, Ozaukee Co., Wisconsin.
68019	copper spear point (socketted)	North shore of Lake Winnebago, Winnebago Co., Wisconsin.
68020	copper spear point (tanged)	Neenah, Winnebago Co., Wisconsin.
68022	copper knife (socketted)	Wisconsin.
68023	copper spear point (socketted)	Westfield, Marquette Co., Wisconsin.
68026	copper spear point (socketted)	Same as above.

APPENDIX A
ARCHAIC COPPER ARTIFACTS TABLE #1: PROVENIENCE (continued)

FMNH #	DESCRIPTION	LOCATION OF FIND
68028	copper spear point (socketted)	Oshkosh, Winnebago Co., Wisconsin.
68033	copper spear point (tanged)	Menasha, Winnebago Co., Wisconsin.
68044	copper spear point (socketted)	Same as above.
68045	copper object	Mukwonago, Waukesha Co., Wisconsin.
68046	copper spear point (socketted)	Clayton, Winnebago Co., Wisconsin.
68058	copper pin	Lake Superior Ship Canal, Hancock, Hancock Co., Michigan.
68059	copper implement	Same as above.
68061	copper celt	Neenah, Winnebago Co., Wisconsin.
68070	copper knife	Barron, Barron Co., Wisconsin.
68077	copper celt (socketted)	Auburn, Fond du Lac Co., Wisconsin.
68079	copper celt (socketted)	Winneconne, Winnebago Co., Wisconsin.
68080	copper spear point (socketted)	Neenah, Winnebago Co., Wisconsin.
68084	copper spear point (tanged)	Lake Superior Ship Canal, Hancock, Hancock Co., Michigan.
68087	copper spear point (tanged)	North of State Hospital, Winnebago Co., Wisconsin.
68089	copper celt	Menasha, Winnebago Co., Wisconsin.
68091	copper spear point (corner notched)	Winchester, Winnebago Co., Wisconsin.
68092	copper spear point (tanged)	Edgerton, Rock Co., Wisconsin.
68097	copper spear point (fragment)	Neenah, Winnebago Co., Wisconsin.
68098	copper spear point (tanged)	Winneconne, Winnebago Co., Wisconsin.
68101	copper knife	Albany, Green Co., Wisconsin.
68102	copper spear point (socketted)	Lake Superior Ship Canal, Houghton Co., Michigan
68103	copper celt	Menasha, Winnebago Co, Wisconsin.

APPENDIX A
ARCHAIC COPPER ARTIFACTS TABLE #1: PROVENIENCE (continued)

FMNH #	DESCRIPTION	LOCATION OF FIND
68107	copper spear point (socketted)	Ontonagon, Ontonagon Co., Wisconsin.
68109	copper spear point (socketted)	Wisconsin.
68110	copper spear point	Portage, Columbia Co., Wisconsin.
68112	copper point (rolled)	Neenah, Winnebago Co., Wisconsin.
68113	copper spear point (socketted)	Winneconne, Winnebago Co., Wisconsin.
68121	copper spear point (socketted)	Hartford, Washington Co., Wisconsin.
68123	copper celt	Princeton, Green Lake Co., Wisconsin.
68124	copper celt	Portage, Columbia Co., Wisconsin.
68125	copper celt fragment	Neenah, Winnebago Co., Wisconsin.
68133	copper knife	Lake Superior Ship Canal, Houghton Co., Michigan.
68138	copper spear point (tanged)	Near Menominee River, Menominee, Michigan.
68142	copper spear point (tanged)	Same as above.
68143	copper spear point (socketted)	Same as above.
68144	copper spear point	Same as above.
68149	copper spear point (socketted)	Lake Superior Ship Canal, Houghton Co., Michigan.
68150	copper spear point (socketted)	Lake Superior Ship Canal, Houghton Co., Michigan.
68151	copper spear point (socketted)	Same as above.
68152	copper fragment	Same as above.
68153	copper fragment	Same as above.
68155	copper point (rolled)	Same as above.
68169	copper awl	Sand dunes near Buffalo Lake, Princeton, Green Lake Co., Wisconsin.
68173	copper implement	Same as above.
68174	copper awl	Same as above.
68175	copper awl	Same as above.
68177	copper "toggle"	Same as above.
68178	copper awl	Same as above.

APPENDIX A
ARCHAIC COPPER ARTIFACTS TABLE #1: PROVENIENCE (continued)

FMNH #	DESCRIPTION	LOCATION OF FIND
68179	copper spear point (socketted)	Sand dunes near Buffalo Lake, Princeton, Green Lake Co., Wisconsin.
68180	copper point (rolled)	Same as above.
68181	copper spear point (tanged)	Same as above.
68183	copper awl	Same as above.
68208	copper spear point (tanged)	"USA"
168160	copper spear point (socketted)	Freedom, Ontagamie Co., Wisconsin.
168161	copper spear point (socketted)	Pound, Marinette Co., Wisconsin.
168163	copper spear point (socketted)	Sherman, Wisconsin.
168166	copper spear point	Greenville, Ontagamie Co., Wisconsin.
168170	copper spear point (socketted)	Forrest St. Croix Co., Wisconsin.
168174	copper spear point (socketted)	Brighton, Kenosha Co., Wisconsin.
168179	copper spear point (socketted)	Milwaukee, Milwaukee Co., Wisconsin.
168186	copper knife	Greenville, Ontagamie Co., Wisconsin.
168188	copper spear point (tanged)	Brown Deer, Milwaukee Co., Wisconsin.
168191	copper knife	Pewaukee, Waukesha Co., Wisconsin.
168192	copper knife	Dayton, Green Co., Wisconsin.
168197	copper celt	Waupaca, Waupaca Co., Wisconsin.
168199	copper spear point (socketted)	Portage Co., Wisconsin.
168495	copper nugget	Wisconsin.

APPENDIX A

ARCHAIC COPPER TABLE #2: COPPER NUGGETS

ARTIFACT #	WEIGHT GR.	LENGTH	WIDTH	THICKNESS
68006-1	384.0	8.7	7.7	1.5
68006-2	190.7	7.6	4.5	1.8
168495	3742.1	23.0	18.2	3.8

APPENDIX A

ARCHAIC COPPER TABLE #3: COPPER BARS

ARTIFACT #	WEIGHT GR.	LENGTH	WIDTH	THICKNESS
52277	220.7	27.6	1.7	0.9
52342	81.8	15.8	1.0	0.9
52344!	36.7	8.5	1.1	0.8

! = fragment

APPENDIX A

ARCHAIC COPPER TABLE #4: PIERCING IMPLEMENTS

ARTIFACT #	WEIGHT GR.	LENGTH	WIDTH	THICKNESS
52010	21.8	15.4	1.4	0.5
52059!	22.5	11.0	1.5	0.3
52178	34.1	15.0	0.8	0.8
52179	20.3	12.0	0.5	0.4
52180	36.2	19.7	0.8	0.5
52181	27.2	16.2	0.6	0.5
52183	33.0	17.6	0.6	0.6
52184	15.1	13.5	0.4	0.4
52185	14.2	11.0	0.5	0.5
52186	22.6	14.1	0.7	0.5
52187	18.3	14.1	0.6	0.5
52188	27.1	13.9	0.6	0.6
52190	25.5	12.0	0.6	0.6
52191	15.0	10.1	0.6	0.5
52192	12.4	13.6	0.4	0.4
52193	11.2	13.8	0.4	0.4
52207	47.9	14.1	2.5	0.6
52240	NA	8.1	0.4	0.4
52241	NA	8.8	0.4	0.4
52294	36.8	18.7	0.6	0.6
52343	13.7	14.5	0.5	0.3
56178	9.9	11.7	0.5	0.3
68058	43.8	19.2	1.4	0.4
68059	20.9	18.1	0.6	0.4
68169	2.4	6.2	0.3	0.2
68173	48.4	12.5	1.1	0.7
68174	6.0	5.9	0.5	0.5
68175	5.0	5.1	0.5	0.4
68177	7.0	6.6	0.5	0.5
68183	3.5	7.8	0.3	0.3

! = fragment

APPENDIX A

ARCHAIC COPPER TABLE #5: TRIANGULAR SOCKETTED SPEAR POINTS

ARTIFACT #	WEIGHT GR.	LENGTH	WIDTH	THICKNESS
52006	19.1	8.1	1.8	0.5
52011	47.7	12.8	2.4	0.5
52013	23.1	11.7	1.8	0.3
52025	26.6	13.2	1.7	0.3
52028	32.3	12.9	1.9	0.4
52033	19.1	11.7	0.7	0.3
52042	17.7	12.0	1.5	0.2
52060	15.5	11.2	1.5	0.3
52061	18.2	9.1	1.7	0.3
52068	9.0	6.9	1.2	0.3
52069	15.4	9.9	1.6	0.3
52071	22.8	11.0	2.1	0.3
52073	12.1	9.5	1.2	0.4
52076	12.4	9.5	1.3	0.3
52076?	22.7	11.0	1.4	0.3
52097	35.6	10.6	2.1	0.5
52102	19.5	9.7	1.3	0.3
52106	19.6	14.7	1.7	0.2
52108	29.5	12.0	2.3	0.3
52146	33.0	15.0	1.9	0.4
52161	119.3	23.5	3.2	0.6
52617	67.0	14.2	2.5	0.6
68018	54.0	14.0	2.8	0.5
68044	53.3	14.2	2.6	0.5
68046	41.1	18.5	1.8	0.5
68109	42.4	12.2	2.6	0.4
68179	27.3	9.2	2.4	0.4
168161	53.4	15.4	2.3	0.4
168166	70.0	14.4	2.5	0.6
168170	33.0	10.5	2.1	0.4
168199	49.8	12.5	2.8	0.5

? = mis-numbered

APPENDIX A

ARCHAIC COPPER TABLE #6: OVAL SOCKETTED SPEAR POINTS

ARTIFACT #	WEIGHT GR.	LENGTH	WIDTH	THICKNESS
52030	41.3	12.0	2.7	0.3
52041	54.1	12.2	2.8	0.3
52065	17.2	10.0	1.5	0.3
52132	48.1	10.7	3.2	0.4
52138	83.2	18.4	3.0	0.4
52141	95.0	16.1	3.9	0.4
68013	35.2	11.6	2.3	0.3
68026	54.5	12.0	3.0	0.4
68028	45.4	12.4	2.9	0.3
68080*	47.3	8.4	3.3	0.5
68097!	16.6	10.2	2.8	0.1
68102	16.4	7.2	1.7	0.2
68107	13.5	6.1	1.3	0.3
68113	8.6	6.3	1.3	0.3
68121*	11.5	6.3	1.9	0.2
68143	55.6	11.2	2.8	0.4
68149	15.0	6.8	1.6	0.3
168160	60.1	16.0	2.6	0.3
168163	52.3	14.3	2.7	0.4
168174	50.3	11.8	2.9	0.3
168179	58.8	13.2	2.7	0.3

* = suspected modern replica ! = fragment

APPENDIX A

ARCHAIC COPPER TABLE #7: TANGED SPEAR POINTS

ARTIFACT #	WEIGHT GR.	LENGTH	WIDTH	THICKNESS
52001	60.6	13.7	3.1	0.4
52015	20.4	6.7	2.2	0.3
52016	38.9	9.6	3.1	0.4
52029	36.5	12.2	2.5	0.3
52036	36.8	11.4	2.7	0.4
52037	21.1	11.7	2.0	0.2
52044	52.0	15.6	2.9	0.4
52045	31.5	11.9	2.3	0.3
52052	31.0	9.9	2.6	0.3
52059	22.9	9.6	2.0	0.3
52063	23.4	9.5	2.1	0.3
52610	54.0	10.7	2.9	0.5
68011	44.4	12.2	2.8	0.5
68020	41.9	14.8	2.5	0.4
68033	46.4	13.1	2.3	0.5
68045	56.3	17.2	2.4	0.7
68084	31.5	10.8	2.5	0.3
68087	33.2	8.5	2.4	0.4
68092	7.1	5.7	1.3	0.2
68098	23.0	8.0	2.3	0.3
68110	6.6	7.8	1.0	0.2
68138	85.7	12.8	4.7	0.4
68142	50.4	11.5	4.2	0.4
68144	9.0	5.8	2.1	0.3
68181!	35.5	8.1	3.4	0.4
68208	11.5	7.3	1.9	0.2
168188	54.1	13.1	3.2	0.4

! = fragment

APPENDIX A

ARCHAIC COPPER TABLE #8: NOTCHED SPEAR POINTS

ARTIFACT #	WEIGHT GR.	LENGTH	WIDTH	THICKNESS
52039	35.9	12.7	3.1	0.2
52223	42.0	10.9	4.4	0.2
68012	48.2	12.5	3.5	0.3
68091	8.2	5.1	1.5	0.2

APPENDIX A

ARCHAIC COPPER TABLE #9: ROLLED CONE SPEAR POINTS

ARTIFACT #	WEIGHT GR.	LENGTH	WIDTH	THICKNESS
52283	109.7	11.5	2.7	0.7
68112	20.6	6.7	2.3	0.5
68150	12.0	4.5	1.7	0.3
68151	5.2	6.5	0.8	0.3
68155	2.3	3.3	0.7	0.3
68180	5.1	4.7	0.9	0.1

APPENDIX A

ARCHAIC COPPER TABLE #10: SQUARE EDGED CELTS

ARTIFACT #	WEIGHT GR.	LENGTH	WIDTH	THICKNESS
52168	218.7	14.9	3.4	0.9
52170	778.1	23.5	4.1	1.5
52172	325.9	14.7	3.2	1.1
52174	387.6	14.7	3.8	1.5
52175	690.2	23.5	4.2	1.3
52199	484.7	20.5	3.4	1.2
52203	219.1	12.1	3.6	1.0
52233	125.6	7.7	4.6	0.7
52266	165.0	10.8	4.2	1.0
52340	1138.6	30.0	4.9	1.5
68005U	187.7	7.0	6.8	0.9
68089	54.4	7.3	2.6	1.8
68103	138.4	9.4	3.9	1.0
68123	74.1	9.5	3.0	0.5
68124	124.5	9.6	2.9	1.0
68125!	187.0	10.7	3.7	1.3
168197	141.7	10.4	3.7	0.7

! = fragment U = unfinished

APPENDIX A

ARCHAIC COPPER TABLE #11: SOCKETTED CELTS

ARTIFACT #	WEIGHT GR.	LENGTH	WIDTH	THICKNESS
52174?	1053.3	13.5	10.5	1.2
52229	298.4	8.9	6.4	0.7
52235	14.0	2.9	2.1	0.3
68077	240.9	8.8	4.8	1.1
68079	119.9	7.8	3.8	0.5

? = mis-numbered.

APPENDIX A

ARCHAIC COPPER TABLE #12: KNIVES

ARTIFACT #	WEIGHT GR.	LENGTH	WIDTH	THICKNESS
52007	48.6	12.3	2.8	0.4
52077	27.1	11.2	2.1	0.3
52099!	9.6	7.1	1.3	0.3
52115!	43.9	11.3	2.6	0.3
52123SKT	35.3	14.5	2.2	0.4
52259	52.5	13.6	2.5	0.3
52260	28.9	11.6	2.5	0.3
52262	53.2	15.5	2.8	0.5
68003CR	24.9	12.9	1.5	0.2
68022SKT	73.5	12.2	3.0	0.5
68070	66.8	20.0	2.8	0.3
68133	45.4	14.6	2.0	0.4
168186	47.3	15.8	2.2	0.4
168191CR	44.6	16.9	3.3	0.2
168192	50.0	18.2	2.0	0.4

! = fragment SKT = socket CR = crescent

APPENDIX A

ARCHAIC COPPER TABLE #13: CHISELS

ARTIFACT #	WEIGHT GR.	LENGTH	WIDTH	THICKNESS
52167	91.5	15.0	2.3	0.6
52171	107.0	17.0	2.5	0.7
52202	202.1	13.8	3.0	0.9
52204	95.7	15.2	2.2	0.5
52205	59.3	13.3	2.0	0.5
52206S	41.0	14.5	2.5	0.3
52296S	90.6	10.7	1.5	1.2
68061	131.8	11.0	1.5	1.4
68101	31.9	10.8	2.2	0.3

S = square edge, all others are round

APPENDIX A
ARCHAIC COPPER TABLE #14: ROLLED BEADS

ARTIFACT #	WEIGHT GR.	LENGTH	WIDTH	THICKNESS
52359-1	<0.1	0.7	0.2	<0.05
52359-2	0.1	1.1	0.2	<0.05
52359-3	0.3	1.1	0.2	<0.05
52359-4	0.2	1.2	0.3	<0.05
52359-5	0.3	1.7	0.3	<0.05
52359-6	0.3	1.5	0.3	<0.05
52359-7	0.4	1.7	0.3	<0.05
52359-8	0.5	1.8	0.3	<0.05
52359-9	0.4	1.6	0.4	<0.05
52359-10	0.4	1.7	0.3	<0.05

APPENDIX A

ARCHAIC COPPER TABLE #15: MISCELLANEOUS FRAGMENTS

ARTIFACT #	WEIGHT GR.	LENGTH	WIDTH	THICKNESS
52189	22.5	8.6	1.5	0.3
52347	11.5	4.8	1.1	0.5
68152	9.3	4.7	1.1	0.5
68153	7.0	6.1	0.8	0.4

APPENDIX B
MIDDLE WOODLAND METAL ARTIFACTS

APPENDIX B

HOPEWELL SITE COPPER ARTIFACTS TABLE #1: PROVENIENCE

FMNH #	DESCRIPTION	LOCATION OF FIND
53037	copper nugget	Mound 25
56003	effigy bear tooth	Mound 20, Feature 177
56004	crescent	Mound 20, Feature 176
56005	earspools	Mound 20, Feature 176
56006	bracelet (mismarked)	Mound 25, Copper Deposit
56018	celt	Mound 3
56026	earspools	Mound 17, Feature 169
56027	celt	Mound 17, Feature 169
56028-1	celt	Mound 17, Feature 169
56030	copper plate	Mound 17, Feature 169
56032	rod bracelet	Mound 17
56038-1	celt	Mound 20, Feature 176
56038-3	celt	Mound 20, Feature 176
56039	overlaid large bead	Mound 20, Feature 176
56043	axe	Mound 23
56049	concretion	Mound 23, Feature 187
56057	earspools	Mound 23, Feature 207
56061	earspools	Mound 23, Feature 213
56063	2 boxes fragments	Mound 23, Feature 213
56063	copper plate	Mound 23, Feature 213
56067	button cover	Mound 23, Feature 226
56077	copper plate	Mound 24, Feature 195
56082	copper plate	Mound 25, Feature 248
56083	copper plate	Mound 25, Feature 248
56088	buttons	Mound 25, Feature 248
56100	head plate	Feature 243
56115	copper sheet	Mound 25, Copper Deposit
56116	copper strip	Mound 25, Copper Deposit
56117	folded strip	Mound 25, Copper Deposit
56118	cut-out	Mound 25, Copper Deposit
56119	effigy canine	Mound 25, Copper Deposit
56121	plate	Mound 25, Copper Deposit
56122	cut-out	Mound 25, Copper Deposit
56123	earspool	Mound 25, Copper Deposit
56124	cut-out	Mound 25, Copper Deposit
56127	pendant	Mound 25, Copper Deposit
56129	rod bracelet	Mound 25, Copper Deposit
56130	rod bracelet	Mound 25, Copper Deposit
56131	rod bracelet	Mound 25, Copper Deposit
56133	rod bracelet	Mound 25, Copper Deposit
56134	modified nugget	Mound 25, Copper Deposit
56135	rod bracelet	Mound 25, Copper Deposit
56137	"U" bracelet	Mound 25, Copper Deposit
56138	"U" bracelet	Mound 25, Copper Deposit
56139	rod bracelet	Mound 25, Copper Deposit
56140	"U" bracelet	Mound 25, Copper Deposit

APPENDIX B

HOPEWELL SITE COPPER ARTIFACTS TABLE #1: PROVENIENCE (cont.)

FMNH #	DESCRIPTION	LOCATION OF FIND
56141	"U" bracelet	Mound 25, Copper Deposit
56142	"U" bracelet	Mound 25, Copper Deposit
56143	"U" bracelet	Mound 25, Copper Deposit
56144	"U" bracelet	Mound 25, Copper Deposit
56146	"U" bracelet	Mound 25, Copper Deposit
56147	"U" bracelet	Mound 25, Copper Deposit
56149	"U" bracelet	Mound 25, Copper Deposit
56151	cone brooch	Mound 25, Copper Deposit
56152	cone brooch	Mound 25, Copper Deposit
56153	cone brooch	Mound 25, Copper Deposit
56154	cone brooch	Mound 25, Copper Deposit
56155	cone brooch	Mound 25, Copper Deposit
56157	cut-out	Mound 25, Copper Deposit
56158	cut-out	Mound 25, Copper Deposit
56160	cut-out	Mound 25, Copper Deposit
56161	cut-out	Mound 25, Copper Deposit
56162	cut-out	Mound 25, Copper Deposit
56163	cut-out	Mound 25, Copper Deposit
56164	cut-out	Mound 25, Copper Deposit
56165	cut-out	Mound 25, Copper Deposit
56167	cut-out	Mound 25, Copper Deposit
56168	cut-out	Mound 25, Copper Deposit
56169	circle	Mound 25, Copper Deposit
56173	cut-out	Mound 25, Copper Deposit
56174	effigy fish	Mound 25, Copper Deposit
56176	effigy fish	Mound 25, Copper Deposit
56177	effigy fish	Mound 25, Copper Deposit
56178	cut-out	Mound 25, Copper Deposit
56179	cut-out	Mound 25, Copper Deposit
56180	"bow-tie"	Mound 25, Copper Deposit
56181	"bow-tie"	Mound 25, Copper Deposit
56182	cut-out	Mound 25, Copper Deposit
56183	cut-out	Mound 25, Copper Deposit
56184	cut-out	Mound 25, Copper Deposit
56185	cut-out	Mound 25, Copper Deposit
56186	cut-out	Mound 25, Copper Deposit
56187	cut-out	Mound 25, Copper Deposit
56188	cut-out	Mound 25, Copper Deposit
56189	cut-out	Mound 25, Copper Deposit
56190	cut-out	Mound 25, Copper Deposit
56191	cut-out	Mound 25, Copper Deposit
56192	effigy paw	Mound 25, Copper Deposit
56193	effigy paw	Mound 25, Copper Deposit
56196	cut-out	Mound 25, Copper Deposit
56198	earspool	Mound 25, Copper Deposit
56199	earspool	Mound 25, Copper Deposit

APPENDIX B
HOPEWELL SITE COPPER ARTIFACTS TABLE #1: PROVENIENCE (cont.)

FMNH #	DESCRIPTION	LOCATION OF FIND
56202-1	semi-tubular ring	Mound 25, Copper Deposit
56202-2	semi-tubular ring	Mound 25, Copper Deposit
56204	swastika	Mound 25, Copper Deposit
56205	swastika	Mound 25, Copper Deposit
56206	"forked tongue"	Mound 25, Copper Deposit
56207	"forked tongue"	Mound 25, Copper Deposit
56209	"forked tongue"	Mound 25, Copper Deposit
56210	"forked tongue"	Mound 25, Copper Deposit
56211	cut-out	Mound 25, Copper Deposit
56212	cut-out	Mound 25, Copper Deposit
56213	cut-out	Mound 25, Copper Deposit
56216	circle	Mound 25, Copper Deposit
56218	cut-out fragments	Mound 25, Copper Deposit
56219-1	copper plate	Mound 25, Copper Deposit
56219-2	copper plate	Mound 25, Copper Deposit
56220	copper plate	Mound 25, Copper Deposit
56221	copper plate	Mound 25, Copper Deposit
56222	copper plate	Mound 25, Copper Deposit
56223	copper plate	Mound 25, Copper Deposit
56224	ornament	Mound 25, Copper Deposit
56225	ornament	Mound 25, Copper Deposit
56227	ornament	Mound 25, Copper Deposit
56229	"bowtie"	Mound 25, Copper Deposit
56230	cut-out	Mound 25, Copper Deposit
56232	cut-out	Mound 25, Copper Deposit
56233	disk	Mound 25, Copper Deposit
56240	celt	Mound 25, Feature 260, 261
56241	celt	Mound 25, Feature 260, 261
56242	celt	Mound 25, Feature 260, 261
56243	celt	Mound 25, Feature 260, 261
56246	celt	Mound 25, Feature 260, 261
56247	celt	Mound 25, Feature 260, 261
56248	celt	Mound 25, Feature 260, 261
56250	celt	Mound 25, Feature 260, 261
56253	celt	Mound 25, Feature 260, 261
56254	celt	Mound 25, Feature 260, 261
56255	celt	Mound 25, Feature 260, 261
56256	celt	Mound 25, Feature 260, 261
56259	celt	Mound 25, Feature 260, 261
56261	celt	Mound 25, Feature 260, 261
56263	celt	Mound 25, Feature 260, 261
56264	celt	Mound 25, Feature 260, 261
56265	celt	Mound 25, Feature 260, 261
56267	celt	Mound 25, Feature 260, 261
56268	iron celt	Mound 25, Feature 260, 261
56270	iron celt	Mound 25, Feature 260, 261

APPENDIX B

HOPEWELL SITE COPPER ARTIFACTS TABLE #1: PROVENIENCE (cont.)

FMNH #	DESCRIPTION	LOCATION OF FIND
56271	celt	Mound 25, Feature 260, 261
56272	celt	Mound 25, Feature 260, 261
56273	celt	Mound 25, Feature 260, 261
56274	celt	Mound 25, Feature 260, 261
56275	celt	Mound 25, Feature 260, 261
56276	celt	Mound 25, Feature 260, 261
56281	celt	Mound 25, Feature 260, 261
56282	celt	Mound 25, Feature 260, 261
56283	celt	Mound 25, Feature 260, 261
56284	celt	Mound 25, Feature 260, 261
56285	celt	Mound 25, Feature 260, 261
56288	celt	Mound 25, Feature 260, 261
56290	celt	Mound 25, Feature 260, 261
56291	celt	Mound 25, Feature 260, 261
56292	celt	Mound 25, Feature 260, 261
56296-1	celt	Mound 25, Feature 260, 261
56296-2	celt	Mound 25, Feature 260, 261
56297	axe	Mound 25, Feature 260, 261
56304	celt	Mound 25, Feature 260, 261
56306	iron blank	Mound 25, Feature 260, 261
56309	hammered nugget	Mound 25, Feature 260, 261
56310	nugget	Mound 25, Feature 260, 261
56311	nugget	Mound 25, Feature 260, 261
56312	nugget	Mound 25, Feature 260, 261
56313	nugget	Mound 25, Feature 260, 261
56314	nugget	Mound 25, Feature 260, 261
56315	nugget	Mound 25, Feature 260, 261
56316	nugget	Mound 25, Feature 260, 261
56317	nugget	Mound 25, Feature 260, 261
56319	nugget	Mound 25, Feature 260, 261
56321	nugget	Mound 25, Feature 260, 261
56322	nugget	Mound 25, Feature 260, 261
56323	nugget	Mound 25, Feature 260, 261
56324	nugget	Mound 25, Feature 260, 261
56325	iron blank	Mound 25, Feature 260, 261
56326	nugget	Mound 25, Feature 260, 261
56327	nugget	Mound 25, Feature 260, 261
56328	fragment/dust	Mound 25, Feature 260, 261
56329	nugget	Mound 25, Feature 260, 261
56330	fragment/dust	Mound 25, Feature 260, 261
56331	copper plate	Mound 25, Feature 260, 261
56332	copper plate	Mound 25, Feature 260, 261
56333	copper plate	Mound 25, Feature 260, 261
56334	copper plate	Mound 25, Feature 260, 261
56335	copper plate	Mound 25, Feature 260, 261
56337-1	copper plate	Mound 25, Feature 260, 261

APPENDIX B
HOPEWELL SITE COPPER ARTIFACTS TABLE #1: PROVENIENCE (cont.)

FMNH #	DESCRIPTION	LOCATION OF FIND
56337-2	copper plate	Mound 25, Feature 260, 261
56338	copper plate	Mound 25, Feature 260, 261
56339	copper plate	Mound 25, Feature 260, 261
56340	copper plate	Mound 25, Feature 260, 261
56343	copper plate	Mound 25, Feature 260, 261
56345	copper plate	Mound 25, Feature 260, 261
56346-6	cover	Mound 25, Feature 260, 261
56348	beads	Mound 25, Feature 260, 261
56349	plate fragments	Mound 25, Feature 260, 261
56351	copper plate	Mound 25, Feature 260, 261
56353	modified nugget	Mound 25, Feature 260, 261
56354	copper plate	Mound 25, Feature 260, 261
56355	copper plate	Mound 25, Feature 260, 261
56357	copper plate	Mound 25, Feature 260, 261
56360	copper plate	Mound 25, Feature 260, 261
56361	headdress	Mound 25, Feature 260, 261
56361	earspools	Mound 25, Feature 260, 261
56363	copper plate	Mound 25, Feature 260, 261
56364	headdress	Mound 25, Feature 260, 261
56370	plate fragments	Mound 25, Feature 260, 261
56375	copper plate	Mound 25, Feature 268
56379	celt	Mound 25, Feature 264
56395	plate fragments	Mound 25, Feature 270
56396	plate fragments	Mound 25, Feature 277
56399	earspools	Mound 25, Feature 274
56405	copper plate	Mound 25, Feature 281
56406	copper plate	Mound 25, Feature 281
56409	beads	Mound 25, Feature 281
56410	earspools	Mound 25, Feature 281
56411	beads	Mound 25, Feature 281
56433	iron beads	Mound 25, Altar 1
56532	abrader	Mound 25, Altar 1
56541	chert	Mound 25, Altar 1
56544	shale	Mound 25, Altar 1
56584	buttons	Mound 25, Altar 1
56590	panpipe	Mound 25, Altar 1
56591	cut-out fragments	Mound 25, Altar 1
56593	panpipe fragments	Mound 17, Feature 169
56596	earspool fragments	Mound 17, Feature 169
56702	effigy antler	Mound 25, Copper Deposit
56703	earspool concretion	Unknown
56705	earspool concretion	Unknown
56706	earspools	Unknown
56707	silver earspools	Unknown
56708	panpipe	Unknown
56711	piercing implement	Unknown

APPENDIX B

HOPEWELL SITE COPPER ARTIFACTS TABLE #1: PROVENIENCE (cont.)

FMNH #	DESCRIPTION	LOCATION OF FIND
56712	piercing implement	Mound 25
56738	bead	Unknown
56739	button cover	Unknown
56740	silver beads	Unknown
56767	iron chisels	Mound 25, Altar 1
56849-2	concretion	Unknown
110115	disk	Unknown
110117	pendant	Unknown
110118	cut-outs	Unknown
110119	cut-out	Unknown

APPENDIX B

HOPEWELL COPPER ARTIFACTS TABLE #2: BLANKS & NUGGETS

ARTIFACT #	WEIGHT GR.	LENGTH (CM)	WIDTH (CM)	THICK.(CM)
53037	714.2	12.8	10.5	1.8
56134	486.7	8.1	4.8	3.4
56306(Fe)	1264.3	11.0	7.0	2.9
56309	170.9	8.0	6.2	0.8
56310	175.1	5.9	5.7	1.6
56311	216.4	10.0	8.7	1.2
56312	65.0	6.3	5.0	0.9
56313	56.4	7.0	6.5	0.5
56314	51.2	6.5	4.5	0.7
56321	85.7	7.2	6.4	0.9
56223	102.5	8.4	7.5	0.9
56324	116.0	9.0	7.3	0.8
56326	75.4	6.5	6.0	0.7
56329	21.4	4.5	3.0	0.5
56315	117.1	5.2	3.7	1.9
56325(Fe)	74.9	3.8	2.8	2.2
56316	36.5	4.4	3.1	1.5
56317	156.9	9.0	5.2	1.2
56319	127.6	5.0	3.7	2.4
56322	160.5	5.5	3.5	3.4
56327	59.2	4.3	3.7	2.0

all artifacts are copper unless marked

APPENDIX B
HOPEWELL COPPER ARTIFACTS TABLE #3: AXES

ARTIFACT #	WEIGHT GR.	LENGTH (CM)	WIDTH (CM)	THICK.(CM)
56043	5443.1	30.7	13.4	3.7
56267	1753.1	25.5	13.0	1.3
56268	821.4	20.4	9.6	0.9
56297	12814.0	63.0	12.8	4.4

APPENDIX B
HOPEWELL COPPER ARTIFACTS TABLE #4: CELTS

ARTIFACT #	WEIGHT GR.	LENGTH (CM)	WIDTH (CM)	THICK.(CM)
56027	399.3	9.9	7.5	1.4
56028-1	204.6	9.3	5.0	1.0
56038-1	281.2	10.5	5.7	0.9
56038-3	220.6	8.4	6.1	0.9
56240	489.2	11.9	6.3	1.5
56242	552.2	13.9	7.6	1.3
56243	314.5	11.3	6.7	1.0
56246	415.8	12.3	6.8	1.2
56247	208.6	10.3	5.4	1.2
56248	204.9	9.5	5.7	1.2
56250	120.1	9.8	5.4	1.2
56253	147.0	9.0	4.8	1.0
56254	136.3	7.6	4.4	1.2
56255	154.1	9.2	5.2	1.0
56256	98.8	8.3	4.5	0.9
56259	286.0	10.6	5.9	1.4
56261	144.4	8.6	4.9	1.1
56263	139.3	9.0	5.2	1.0
56264	147.5	8.7	5.3	1.1
56265	1019.7	20.2	9.7	1.2
56268	308.9	11.0	6.0	1.3
56270	158.4	9.7	5.3	0.9
56272	426.1	12.5	7.0	1.4
56273	211.5	10.5	6.1	1.2
56274	156.1	8.5	5.1	1.0
56275	192.2	8.2	4.7	1.4
56276	146.9	9.0	5.1	1.1
56281	154.2	8.4	4.7	1.1
56282	111.5	8.2	4.2	1.0
56283	234.5	13.8	5.9	1.1
56284	103.1	7.8	4.7	1.1
56285	123.8	8.6	4.3	0.9
56288	88.4	7.1	4.3	0.9
56290	46.0	5.5	3.7	0.8
56291	42.2	5.6	3.2	0.7
56292	105.0	7.9	4.3	0.9
56296	274.8	10.8	5.9	0.8
56304	985.2	20.7	9.5	1.4
56306	53.6	6.9	3.7	0.6
56379	425.0	12.7	6.7	1.4

APPENDIX B
HOPEWELL COPPER ARTIFACTS TABLE #5: IRON CHISELS

ARTIFACT #	WEIGHT GR.	LENGTH (CM)	WIDTH (CM)	THICK.(CM)
56767-2	5.9	2.7	1.3	1.0
56767-3	8.0	4.5	1.4	1.2

APPENDIX B

HOPEWELL COPPER ARTIFACTS TABLE #6: BRACELETS

ARTIFACT #	WEIGHT GR.	L.(CM)	W.(CM)	T.(CM)	M.T.(CM)
56129S	156.4	9.1	8.6	1.0	
56130S	51.4	7.5	7.2	0.8	
56131S	71.4	8.0	7.4	0.8	
56133S	99.1	9.0	8.3	1.0	
56135S	160.9	9.2	8.8	1.0	
56138H	121.8	9.6	9.4	1.8	0.3
56139-1H	49.7	9.0	9.0	1.1	0.2
56139-2S	40.4	7.4	6.7	0.6	
56140H	93.3	9.0	9.4	2.0	0.2
56141H	92.8	9.8	9.8	2.0	0.2
56142H	69.9	9.5	9.2	1.4	0.2
56143H	49.9	9.2	9.2	1.4	0.1
56144H	66.8	9.0	8.9	0.5	0.2
56146H	51.9	9.0	8.8	1.2	0.1
56147H	49.1	9.1	8.9	1.2	0.1
56149H	140.4	10.2	7.7	2.1	0.3

S = Solid H = Hollow

APPENDIX B
HOPEWELL COPPER ARTIFACTS TABLE #7: BROOCHES

ARTIFACT #	WEIGHT GR.	LENGTH (CM)	WIDTH (CM)	THICK.(CM)
56151	57.9	11.2	11.1	0.1
56152	56.8	11.2	11.1	0.1
56153	42.8	12.0	11.5	0.1
56154	53.0	11.2	10.5	0.1
56155	29.3	9.5	9.4	0.1

APPENDIX B

HOPEWELL COPPER ARTIFACTS TABLE #8: ROLLED TUBE BEADS

ARTIFACT #	WEIGHT GR.	LENGTH (CM)	WIDTH (CM)	THICK.(CM)
56348-1Cu	1.0	1.0	0.9	0.7
56348-2Cu	1.4	1.3	0.9	0.9
56348-3Cu	2.7	2.7	0.9	0.9
56348-4Cu	2.9	5.3	1.0	0.9
56348-5Cu	2.0	1.4	1.3	1.3
56409-1-149Cu	53.6	0.3-2.9	0.6-0.9	0.6-0.9
56409-150-202Cu	8.5	0.2-1.0	0.6-0.9	0.6-0.9
56409-203-240Cu	3.7	NA	NA	NA
56433-1-187Fe	107.6	0.5-1.8	0.3-1.1	0.3-1.0
56433-188-250Fe	91.7	NA	NA	NA

Cu = Copper Fe = Iron

APPENDIX B

HOPEWELL COPPER ARTIFACTS TABLE #9: CLAD STONE BEADS

ARTIFACT #	WEIGHT GR.	LENGTH (CM)	WIDTH (CM)	THICK.(CM)
56039Cu	126.7	8.7	6.6	2.6
56411-1Cu	42.8	4.3	4.2	2.5
56411-2Cu	35.3	3.9	3.8	2.2
56411-3Cu	41.2	4.0	4.0	2.3
56378Cu	62.5	4.5	4.4	3.3
56740-1Ag	12.6	4.0	3.8	1.1
56740-2Ag	3.5	1.7	1.6	1.1

Cu = Copper Ag = Silver

APPENDIX B
HOPEWELL COPPER ARTIFACTS TABLE #10: COPPER BUTTONS

ARTIFACT #	WEIGHT GR.	LENGTH (CM)	WIDTH (CM)	THICK.(CM)
56088-1	5.5	2.3	2.2	1.0
56088-2	3.4	1.8	1.8	0.9
56088-3	2.9	1.6	1.6	0.9
56088-4	NA	NA	NA	NA
56088-5	1.7	1.4	1.4	0.7
56088-6	0.5	0.9	0.9	0.5
56088-7	3.3	1.7	1.7	1.0
56088-8	2.8	1.7	1.7	0.9
56088-9	3.0	1.8	1.7	1.0
56088-10	1.4	1.7	1.7	0.9
56088-11	3.8	2.0	1.9	1.1
56088-12	3.8	2.0	1.9	1.1
56088-13	1.7	1.4	1.4	0.6
56584-1	0.7	1.0	1.0	0.8
56584-2	0.2	1.0	1.0	0.6
56584-3	0.3	1.0	0.9	0.5
56584-4	0.6	0.5	0.4	0.6
56584-5	0.4	0.9	0.9	0.5
56584-6	0.3	0.9	0.9	0.5
56584-7	7.8	2.4	2.2	1.6
56584-8	0.4	0.8	0.8	0.4
56584-9	0.3	0.9	0.9	0.4
56584-10	4.4	1.9	1.9	1.0
56584-11	3.2	1.8	1.8	1.0
56584-12	3.1	1.8	1.8	1.0
56584-13	1.7	1.5	1.5	0.8
56584-14	1.5	1.3	1.3	1.1
56584-15	3.5	1.9	1.6	1.3
56584-16	2.2	1.5	1.5	0.8
56584-17	2.7	1.7	1.7	0.9
56584-18	2.6	1.7	1.7	1.7
56584-19	3.0	1.7	1.7	1.0
56584-20	2.5	1.5	1.5	1.0
56584-21	2.4	1.5	1.5	0.8
56584-22	3.5	1.8	1.8	1.0
56584-23	1.6	1.4	1.4	0.7
56584-24	3.0	1.6	1.5	1.0
56584-25	2.8	1.6	1.5	0.9
56584-26	2.0	1.7	1.7	0.8
56584-27	1.6	1.4	1.4	0.7
56584-28	2.0	1.4	1.4	0.9
56584-29	4.6	1.9	1.8	1.2
56584-30	2.4	1.5	1.5	1.0
56584-31	1.8	1.5	1.5	0.8
56584-32	1.3	1.3	1.3	0.7

APPENDIX B
HOPEWELL COPPER ARTIFACTS TABLE #10: COPPER BUTTONS (cont.)

ARTIFACT #	WEIGHT GR.	LENGTH (CM)	WIDTH (CM)	THICK.(CM)
56584-33	1.8	1.4	1.4	0.9
56584-34	0.5	1.7	1.7	0.9
56584-35	2.1	1.5	1.5	0.9
56584-36	2.7	1.8	1.7	0.9
56584-37	1.6	1.9	1.9	0.7
56584-38	3.5	1.6	1.6	1.0
56584-39	3.3	1.8	1.8	1.0
56584-40	2.9	1.7	1.7	1.1
56584-41	1.8	1.5	1.5	0.8
56584-42	2.0	1.7	1.6	0.7
56584-43	2.8	1.7	1.7	0.9
56584-44	2.0	1.8	1.7	0.8
56584-45	3.0	1.9	1.9	1.0
56584-46	3.3	1.8	1.8	0.9
56584-47	3.9	1.8	1.8	1.1
56584-48	2.0	1.6	1.6	0.8
56584-49	2.2	1.8	1.6	0.8
56584-50	2.7	1.8	1.5	0.8
56584-51	1.5	1.6	1.5	0.7
56584-52	1.9	2.0	1.8	0.8
56584-53	1.5	1.4	1.3	0.9
56584-54	1.9	1.5	1.5	0.7
56584-55	1.8	1.6	1.6	0.9
56584-56	1.0	1.1	1.1	0.6
56584-57	0.5	1.0	1.0	0.6
56584-58	0.5	1.0	1.0	0.5
56584-59	2.4	1.5	1.5	0.9
56584-60	9.5	2.6	2.5	1.3
56739	11.2	3.2	3.1	1.7

APPENDIX B
HOPEWELL COPPER ARTIFACTS TABLE #11: EARSPOOLS

ARTIFACT #	WEIGHT GR.	LENGTH (CM)	WIDTH (CM)	THICK.(CM)
56005-1	6.2	4.4	4.4	0.4
56005-2	20.8	4.5	4.5	1.0
56005-3	11.4	4.0	4.0	0.9
56005-4	11.0	4.0	4.0	1.0
56005-5	20.0	4.4	4.4	1.0
56005-6	13.5	4.5	4.5	1.2
56005-7	10.6	4.1	4.1	0.8
56005-8	5.8	4.1	4.1	0.5
56005-9	3.5	3.9	3.9	0.6
56005-10	7.0	4.3	4.3	0.6
56005-11	10.4	4.4	4.4	1.1
56005-12	31.4	5.0	5.0	1.2
56005-13	24.6	4.4	4.4	1.5
56005-14	28.8	4.3	4.3	1.5
56026-1	17.0	5.4	5.0	0.1
56026-2	13.4	5.3	5.3	0.7
56026-3	7.0	4.4	3.9	0.1
56026-4	17.7	5.6	5.3	0.1
56026-5	8.4	4.5	4.2	0.1
56026-6	8.9	4.5	4.5	0.1
56026-7	17.5	5.2	5.2	0.6
56026-8	25.0	4.3	4.2	0.4
56026-9	10.0	4.7	4.7	0.6
56057-1	17.5	4.8	4.7	1.4
56057-2	20.1	4.0	3.7	1.0
56057-3	13.9	4.4	3.6	1.2
56057-4	14.0	3.7	2.5	0.7
56057-5	10.5	4.3	4.2	0.9
56057-6	14.8	3.5	2.8	0.9
56057-7	20.4	NA	NA	NA
56061-1	12.0	4.5	4.5	0.8
56061-2	39.4	4.4	4.2	2.2
56061-3	35.6	4.2	4.2	2.3
56061-4	38.8	4.4	4.4	2.2
56198	64.6	5.4	5.4	1.2
56199	60.2	5.5	5.5	1.2
56361-14	36.0	4.2	3.9	0.9
56361-15	12.8	4.3	4.3	1.1
56410-1	10.2	3.6	3.6	1.0
56410-2	12.3	3.6	3.6	1.0
56410-3	10.7	4.1	4.1	1.1
56703-1-14	287.5	12.2	6.8	5.4
56705-1-16	399.5	13.5	11.0	5.2
56706-1	38.8	3.8	3.8	2.0
56706-2	38.2	3.8	3.8	2.2

APPENDIX B

HOPEWELL COPPER ARTIFACTS TABLE #11: EARSPOOLS (continued)

ARTIFACT #	WEIGHT GR.	LENGTH (CM)	WIDTH (CM)	THICK.(CM)
56706-3	36.5	3.8	3.7	2.0
56706-4	32.0	3.7	3.7	2.0
56707-1Ag	17.8	4.1	4.1	0.2
56707-2Ag	12.9	4.2	4.2	0.2
56849-1-5	260.7	11.0	8.1	4.9

Ag = Silver

APPENDIX B
HOPEWELL COPPER ARTIFACTS TABLE #12: Breastplates

ARTIFACT #	WEIGHT GR.	LENGTH (CM)	WIDTH (CM)	THICK.(CM)
56030	209.6	19.8	11.0	0.1
56060-1	216.7	18.5	13.0	0.4
56060-2	53.1	12.0	9.2	0.3
56060-3-9	78.0	NA	NA	NA
56063-10-18	55.7	NA	NA	NA
56063-19	20.0	6.4	4.2	0.5
56063-20	5.8	4.0	3.7	0.3
56063-21	202.0	19.0	11.0	0.3
56063-22	258.1	23.2	12.9	0.2
56077	234.6	24.0	13.0	0.2
56082	463.9	25.2	13.2	0.2
56083	285.2	22.0	12.0	0.3
56331	319.5	26.0	14.5	0.2
56332-1	225.7	13.3	9.8	0.4
56332-2	9.0	4.4	3.2	0.3
56332-3	3.8	3.9	2.4	0.4
56332-4	1.1	1.9	1.8	0.2
56333	234.0	24.5	13.5	0.3
56334	249.4	20.5	14.6	0.2
56335	146.3	22.7	10.3	0.2
56337-1	306.2	24.0	13.7	0.2
56337-2	501.3	33.0	13.5	0.6
56338	180.7	21.4	12.1	0.1
56339	137.5	12.7	12.0	0.3
56343-1	139.0	14.0	11.0	0.3
56343-2	129.7	13.8	10.2	0.3
56343-3	43.4	10.1	6.0	0.3
56343-4	30.9	6.8	6.7	0.4
56343-5-31	140.1	NA	NA	NA
56345	295.4	24.0	13.0	0.2
56349-1	245.3	19.9	12.2	0.4
56349-2	87.4	10.7	10.5	0.2
56349-3	70.0	16.5	8.8	0.2
56349-4	48.5	11.8	5.9	0.2
56349-5	39.1	12.5	6.1	0.2
56351	73.4	11.0	8.5	0.2
56354	121.2	13.0	10.5	0.3
56355	168.5	19.0	10.7	0.2
56357	178.5	15.2	13.0	0.2
56359	83.0	11.8	8.2	0.2
56360	118.4	13.5	10.0	0.2
56363	124.3	22.0	6.5	0.2
56370-2	306.0	27.3	16.2	0.3
56370-3	214.4	21.0	13.0	0.2
56370-4	36.3	7.5	7.1	0.3

APPENDIX B

HOPEWELL COPPER ARTIFACTS TABLE #12: Breastplates (cont.)

ARTIFACT #	WEIGHT GR.	LENGTH (CM)	WIDTH (CM)	THICK.(CM)
56370-5	13.5	4.5	3.9	0.2
56370-9	6.7	4.2	2.8	0.3
56370-10	40.8	10.6	5.0	0.2
56370-11	34.8	5.8	5.7	0.3
56370-12	18.7	5.5	5.2	0.3
56370-13	5.6	5.2	3.2	0.1
56370-14	11.8	4.6	3.2	0.3
56370-17	0.8	1.3	0.8	0.6
56375	241.8	21.5	11.6	0.1
56395-1	45.2	11.5	6.9	0.2
56395-2	112.9	12.5	10.9	0.2
56396-1	12.4	6.2	3.2	0.2
56396-2	101.7	13.5	11.5	0.5
56405	630.8	31.5	17.1	0.2
56406	346.5	21.0	12.5	0.2

APPENDIX B
HOPEWELL COPPER ARTIFACTS TABLE #13: COPPER STRIPS

ARTIFACT #	WEIGHT GR.	LENGTH (CM)	WIDTH (CM)	THICK.(CM)
56116	19.5	10.7	4.9	0.1
56219-1	209.1	26.3	9.4	0.2
56219-2	39.3	9.5	9.0	0.1
56220	90.1	19.1	9.2	0.1
56221	17.0	9.9	4.8	0.1
56222-1	5.6	6.2	2.9	0.1
56222-2	2.1	3.0	2.8	0.1

APPENDIX B
HOPEWELL COPPER ARTIFACTS TABLE #14: PANPIPES

ARTIFACT #	WEIGHT GR.	LENGTH (CM)	WIDTH (CM)	THICK.(CM)
56006	83.8	6.8	4.8	2.2
56115	9.2	6.0	2.5	0.4
56117	19.2	8.4	3.4	2.2
56223	12.3	9.0	3.5	0.1
56590	62.6	NA	NA	NA
56593	9.3	NA	NA	NA
56708	70.5	9.1	5.4	1.7

APPENDIX B
HOPEWELL COPPER ARTIFACTS TABLE #15: EFFIGY SHEETS

ARTIFACT #	WEIGHT GR.	LENGTH (CM)	WIDTH (CM)	THICK.(CM)
56174	46.6	20.5	9.9	0.1
56176	15.6	12.8	5.1	0.1
56177	19.5	14.2	7.0	0.1
56192	28.1	7.6	7.5	0.1
56193	24.1	7.8	7.5	0.1
56702	98.2	32.0	20.0	0.1
56356	NA	40.0	13.0	0.6

APPENDIX B
HOPEWELL COPPER ARTIFACTS TABLE #16: CUT-OUTS

ARTIFACT #	WEIGHT GR.	LENGTH (CM)	WIDTH (CM)	THICK.(CM)
56004	42.8	20.3	3.3	0.1
56067	7.7	4.8	3.0	0.1
56118	7.4	7.1	1.7	0.1
56119	23.0	8.8	2.2	0.1
56121	3.1	5.5	2.8	0.1
56122	1.3	4.7	2.0	0.1
56124	2.3	4.0	2.6	0.1
56157	27.7	12.2	6.2	0.1
56158	20.0	12.3	6.2	0.1
56160	29.5	12.3	6.5	0.1
56161	115.9	16.2	16.0	0.1
56162	85.0	16.0	16.0	0.2
56163	121.6	21.4	15.5	0.1
56164	87.6	18.7	18.3	0.1
56165	100.6	31.3	12.0	0.1
56167	11.3	10.6	5.1	0.1
56168	8.0	10.5	5.4	0.1
56169	2.0	3.1	3.1	0.1
56173	4.9	7.5	2.9	0.1
56174	46.6	20.5	9.9	0.1
56176	15.6	12.8	5.1	0.1
56177	19.5	14.2	7.0	0.1
56178	10.9	10.0	8.5	0.1
56179	11.0	10.1	8.5	0.1
56180	7.1	8.8	2.9	0.1
56181	5.7	8.4	2.8	0.1
56182	10.4	8.2	7.5	0.1
56183	8.8	11.0	4.8	0.1
56184	22.0	14.0	7.5	0.1
56185	25.5	17.8	7.4	0.1
56186	15.6	9.8	7.6	0.1
56187	9.9	12.5	3.5	0.1
56188	16.2	17.0	5.2	0.1
56189	19.6	16.7	6.1	0.1
56190	13.8	11.8	5.9	0.1
56191	21.9	12.5	4.5	0.1
56192	28.1	7.6	7.5	0.1
56193	24.1	7.8	7.5	0.1
56196	22.7	20.4	3.8	0.1
56202-1	16.4	5.9	5.9	0.1
56202-2	24.2	5.9	5.9	0.1
56204	36.8	11.0	10.9	0.1
56205	10.0	7.7	7.1	0.1
56206	10.5	19.6	5.8	0.1
56207	9.2	17.2	4.5	0.1

APPENDIX B
HOPEWELL COPPER ARTIFACTS TABLE #16: CUT-OUTS (continued)

ARTIFACT #	WEIGHT GR.	LENGTH (CM)	WIDTH (CM)	THICK.(CM)
56209	5.6	17.0	1.5	0.1
56210	4.1	16.2	1.8	0.1
56211	11.3	8.8	6.4	0.1
56212	3.3	8.8	1.8	0.1
56213	24.0	14.5	6.4	0.1
56216	2.0	3.1	3.1	0.1
56218-1	1.0	3.0	0.8	0.1
56218-2	1.1	2.4	1.4	0.1
56224	72.5	18.2	4.8	0.2
56225	27.4	19.8	4.8	0.1
56227	37.7	18.5	4.5	0.1
56229	6.4	7.0	2.8	0.1
56230	2.5	3.5	3.0	0.1
56232	1.9	3.5	2.0	0.1
56591-1	0.6	2.1	2.0	0.1
56591-2	0.8	2.6	0.7	0.3
56591-3	0.8	2.8	1.4	0.1
56591-4	1.6	3.5	1.6	0.2
56591-5	0.8	3.3	1.6	0.1
110117	15.3	12.7	4.8	0.1
110119	23.6	11.8	5.2	0.2

APPENDIX B
HOPEWELL COPPER ARTIFACTS TABLE #17: HEADDRESSES

ARTIFACT #	WEIGHT GR.	LENGTH (CM)	WIDTH (CM)	THICK.(CM)
56100	125.0	11.4	10.5	0.2
56364	332.4	30.0	10.3	0.8

APPENDIX C
MISSISSIPPIAN COPPER ARTIFACTS

APPENDIX C
ETOWAH COPPER ARTIFACTS TABLE #1: PROVENIENCE

CATALOG #	DESCRIPTION	LOCATION OF FIND
378	earspool	Burial #1, Mound C.
442-1	raptor wing headdress	Burial #20, Mound C.
442-2	effigy hair bun	Burial #20, Mound C.
442-3	effigy hair bun	Burial #20, Mound C.
463-1	sun gorget	Burial #25, Mound C.
463-2	sun gorget	Burial #25, Mound C.
463-3	ogee headdress	Burial #25, Mound C.
483	baton headdress	Burial #28, Mound C.
521	arrow symbol badge	Burial #38, MoundC.
522	arrow symbol badge	Burial #38, MoundC.
523	arrow symbol badge	Burial #38, MoundC.
524	arrow symbol badge	Burial #38, MoundC.
525	mace symbol badge	Burial #38, MoundC.
526	arrow symbol badge	Burial #38, MoundC.
527	arrow symbol badge	Burial #38, MoundC.
528-1	arrow symbol badge	Burial #38, MoundC.
528-2	arrow symbol badge	Burial #38, MoundC.
528-3	arrow symbol badge	Burial #38, MoundC.
529	arrow symbol badge	Burial #38, MoundC.
530-1	mace symbol badge	Burial #38, MoundC.
530-2	arrow symbol badge	Burial #38, MoundC.
531	arrow symbol badge	Burial #38, MoundC.
532-1	mace symbol badge	Burial #38, MoundC.
532-2	arrow symbol badge	Burial #38, MoundC.
533-1	mace symbol badge	Burial #38, MoundC.
532-2	arrow symbol badge	Burial #38, MoundC.
537	arrow symbol badge	Burial #38, MoundC.
541	arrow symbol badge	Burial #38, Mound C.
542	arrow symbol badge	Burial #38, Mound C.
560	axe #3	Burial #38, Mound C.
561	axe #4	Burial #38, Mound C.
563	axe #1	Burial #38, Mound C.
568	axe #2	Burial #38, Mound C.
568-2	axe	Mismarked.
578	axe #5	Burial #38, Mound C.
598-1	shell rattle	Burial #38, Mound C.
598-2	shell rattle	Burial #38, Mound C.
642	axe	Burial #42, Mound C.
733-1	mace symbol badge	Burial #48, Mound C.
733-2	mace symbol badge	Burial #48, Mound C.
733-3	mace symbol badge	Burial #48, Mound C.
733-4	mace symbol badge	Burial #48, Mound C.
733-5	mace symbol badge	Burial #48, Mound C.
733-6	mace symbol badge	Burial #48, Mound C.
733-7	mace symbol badge	Burial #48, Mound C.

APPENDIX C
ETOWAH COPPER ARTIFACTS TABLE #1: PROVENIENCE (continued)

CATALOG #	DESCRIPTION	LOCATION OF FIND
733-8	mace symbol badge	Burial #48, Mound C.
733-9	mace symbol badge	Burial #48, Mound C.
782	clad sun gorget	Burial #46, Mound C.
783	bodkins	Burial #46, Mound C..
788	earspools	Burial #52, Mound C.
836	axe	Burial #57, Mound C.
839	axe	Burial #57, Mound C.
910	ogee headdress	Burial #64, Mound C.
943	mace symbol badge	Burial #67, Mound C.
944	mace symbol badge	Burial #67, Mound C.
945	mace symbol badge	Burial #67, Mound C.
946	mace symbol badge	Burial #67, Mound C.
947	mace symbol badge	Burial #67, Mound C.
948	mace symbol badge	Burial #67, Mound C.
949	mace symbol badge	Burial #67, Mound C.
950	mace symbol badge	Burial #67, Mound C.
951	mace symbol badge	Burial #67, Mound C.
952	mace symbol badge	Burial #67, Mound C.
957	mace symbol badge	Burial #67, Mound C.
958	mace symbol badge	Burial #67, Mound C.
1141	baton headdress	Burial #109, Mound C.
1146-1	bilobed arrow	Burial #109, Mound C.
1146-2	bilobed arrow	Burial #109, Mound C.
1146-3	eagle claw badge	Burial #109, Mound C.
1146-4	eagle claw badge	Burial #109, Mound C.
1146-5	feather symbol badge	Burial #109, Mound C.
1146-6	feather symbol badge	Burial #109, Mound C.
1146-7	feather symbol badge	Burial #109, Mound C.
1146-8	symbol badge	Burial #109, Mound C.
1146-9	galena cube	Burial #109, Mound C.
1146-10	shark teeth	Burial #109, Mound C.
1147-1	copper boss	Burial #137, Mound C.
1147-2	earspool	Burial #137, Mound C.
1147-3	earspool	Burial #137, Mound C.
1147-4	earspool	Burial #137, Mound C.
1148-7	earspool	Burial #109, Mound C.
1148-8	earspool	Burial #109, Mound C.
1150-1	effigy rattle	Burial #109, Mound C.
1150-2	effigy rattle	Burial #109, Mound C.
1150-3	effigy rattle	Burial #109, Mound C.
1150-4	effigy rattle	Burial #109, Mound C.
1150-5	effigy rattle	Burial #109, Mound C.
1150-6	effigy rattle	Burial #109, Mound C.
1150-7	effigy rattle	Burial #109, Mound C.
1150-8	effigy rattle	Burial #109, Mound C.

APPENDIX C
ETOWAH COPPER ARTIFACTS TABLE #1: PROVENIENCE (continued)

CATALOG #	DESCRIPTION	LOCATION OF FIND
1150-9	effigy rattle	Burial #109, Mound C.
1231	earspool	Burial #129, Mound C.
1532-4	earspool	Burial #109, Mound C.
1532-5	earspool	Burial #109, Mound C.
1562	axe	Burial #111, Mound C.
1571	earspool	Backdirt, Mound C.
1572-1	earspool	Unknown
1572-2	earspool	Unknown
1573-1	earspool cover	Burial #101, Mound C.
1573-2	ornament	Burial #101, Mound C.
1591-1	small bilobed arrow	Burial #111, Mound C.
1591-2	feather symbol badge	Burial #111, Mound C.
1591	copper fragments	Burial #111, Mound C.
1596-1	earspool cover	Burial #70, Mound C
1596-2	earspool cover	Burial #70, Mound C.
1597	axe	Burial #109, Mound C.
1712	finial	Burial #67, Mound C.
1715	finial	Burial #57, Mound C.
1723	antler from headdress	Burial #79, Mound C.
1729-1	finial	Burial #67, Mound C.
1729-2	finial	Burial #67, Mound C.
1887	clad sun gorget	Burial #148, Mound C.
1888-1	copper tube bead	Burial #148, Mound C.
1888-2	copper tube bead	Burial #148, Mound C.
1888-3	clad copper bead	Burial #148, Mound C.
1888-4	clad copper bead	Burial #148, Mound C.
2061-1	earspool	Burial #164, Mound C.
2061-2	earspool	Burial #164, Mound C.
2062-1	earspool	Burial #161, Mound C.
2062-2	earspool	Burial #161, Mound C.
2062-3	clad copper bead	Burial #161, Mound C.
2062-4	clad copper bead	burial #161, Mound C.
2062-5	clad copper bead	Burial #161, Mound C.
2062-6	clad copper bead	Burial #161, Mound C.
2229	quartz crystal	Burial #148, Mound C.
2536	effigy rattle	Burial #173, Mound C.
2832	stone abrader	Feature #13, Mound C.
2839	stone abrader	Feature #13, Mound C.
2896	steatite tool	Feature #13, Mound C.
3033	earspool	Burial #187, Moumd C.
3197	hammerstone	Core, Mound C.

APPENDIX C
ETOWAH COPPER ARTIFACTS TABLE #1: PROVENIENCE (continued)

CATALOG #	DESCRIPTION	LOCATION OF FIND
3305	earspool cover	Burial #201, Mound C.
3309	arrow symbol badge	Burial #201, Mound C.
3312	ornament	Burial #202, Mound C.
3598-1	earspool	Burial #210, Mound C.
3598-2	earspool	Burial #210, Mound C.

APPENDIX C
LAKE JACKSON COPPER ARTIFACTS TABLE #2: PROVENIENCE

STUDY #	DESCRIPTION	LOCATION OF FIND
1	mace symbol badge	Burial #9, Mound 3
2	mace symbol badge	Burial #9, Mound 3
3	mace symbol badge	Burial #9, Mound 3
4	mace symbol badge	Burial #9, Mound 3
5	mace symbol badge	Burial #9, Mound 3
6	mace symbol badge	Burial #9, Mound 3
7	mace symbol badge	Burial #9, Mound 3
8	mace symbol badge	Burial #9, Mound 3
9	mace symbol badge	Burial #9, Mound 3
10	mace symbol badge	Burial #9, Mound 3
11	raptor dish	Burial #7, Mound 3
12	raptor dish	Burial #7, Mound 3
13	raptor dish	Burial #7, Mound 3
14	raptor dish	Burial #7, Mound 3
15	axe	Burial #50, Mound 3
16	axe	Burial #12, Mound 3
17	axe	Burial #3, Mound 3
18	bead cover	Unknown, Mound 3
19	bead cover	Unknown, Mound 3
20	arrow symbol badge	Burial #40, Mound 3
2349(Lab#)	copper fragments	Burial #1, Mound 3
2349(Lab#)	card A fragments	Burial #1, Mound 3
2349(Lab#)	card B fragments	Burial #1, Mound 3
2349(Lab#)	card C fragments	Burial #1, Mound 3
2349(Lab#)	card D fragments	Burial #1, Mound 3
2349(Lab#)	card E fragments	Burial #1, Mound 3
2349(Lab#)	card F fragments	Burial #1, Mound 3
2349(Lab#)	card G fragments	Burial #1, Mound 3
2349(Lab#)	card H fragments	Burial #1, Mound 3
2349(Lab#)	card I fragments	Burial #1, Mound 3
2349(Lab#)	card J fragments	Burial #1, Mound 3
2349(Lab#)	card K fragments	Burial #1, Mound 3
2846(Lab#)	axe	Burial #11, Mound 3
2847(Lab#)	axe	Burial #30, Mound 3
4148(Lab#)	raptor being plaque	Burial #16, Mound 3
4149(Lab#)	raptor being plaque	Burial #10, Mound 3
4731(Lab#)	raptor being plaque	Burial #7, Mound 3

Study Numbers are temporary.

APPENDIX C
MISSISSIPPIAN COPPER ARTIFACTS
TABLE #3: STEPPED MACE SYMBOL BADGES

ARTIFACT #	WEIGHT GR.	LENGTH(CM)	WIDTH(CM)	THICK.(CM)
E525	2.0	4.1	4.0	0.1
E530	4.3	5.5	3.6	0.1
E532	2.3	4.2	3.5	0.1
E533	1.7	5.2	2.4	0.1
E943	NA	10.4	4.9	NA
E944	NA	10.0	4.9	NA
E945	NA	9.7	5.0	NA
E946	NA	10.0	4.8	NA
E947	NA	9.6	4.0	NA
E948	NA	9.8	4.5	NA
E949	NA	8.5	4.5	NA
E950	NA	9.0	4.9	NA
E951	NA	9.0	4.0	NA
E952	NA	8.6	4.8	NA
E957	NA	8.0	3.6	NA
E958	NA	8.4	4.8	NA
LJ1	8.5	10.0	5.4	0.1
LJ2	6.7	10.5	5.7	0.1
LJ3	7.0	10.5	5.5	0.1
LJ4	8.5	10.1	5.5	0.1
LJ5	6.8	10.1	5.2	0.1
LJ6	5.9	10.3	5.5	0.1
LJ7	5.9	10.1	5.0	0.1
LJ8	8.0	10.2	5.3	0.1
LJ9	8.4	10.3	5.5	0.1
LJ10	6.8	10.1	5.3	0.1

E = Etowah LJ = Lake Jackson

APPENDIX C
MISSISSIPPIAN COPPER ARTIFACTS
TABLE #4: PLAIN MACE SYMBOL BADGES

ARTIFACT #	WEIGHT GR.	LENGTH(CM)	WIDTH(CM)	THICK.(CM)
E733-1	NA	10.3	3.9	NA
E733-2	NA	10.3	3.9	NA
E733-3	NA	10.3	3.9	NA
E733-4	NA	10.4	3.8	NA
E733-5	NA	8.5	3.8	NA
E733-6	NA	8.0	3.3	NA
E733-7	NA	7.5	3.8	NA
E733-8	NA	7.3	3.3	NA
E733-9	NA	8.0	3.5	NA

E = Etowah

APPENDIX C
MISSISSIPPIAN COPPER ARTIFACTS
TABLE #5: ARROW SYMBOL BADGES

ARTIFACT #	WEIGHT GR.	LENGTH(CM)	WIDTH(CM)	THICK.(CM)
E526	1.5	5.5	3.0	0.1
E527	0.8	NA	NA	NA
E528-1	0.3	1.3	1.5	0.1
E528-2	0.3	1.0	1.1	0.1
E537	5.8	3.0	3.0	0.1
E541	3.5	7.3	3.5	0.1
E542	2.0	5.5	2.1	0.1
E521	NA	5.9	3.1	NA
E522	NA	5.0	3.0	NA
E523	NA	5.7	2.8	NA
E524	NA	6.0	3.6	NA
E525	NA	6.0	3.6	NA
E528	NA	5.5	3.2	NA
E529	NA	5.8	4.0	NA
E530	NA	6.9	3.7	NA
E531	NA	4.0	3.3	NA
E532	NA	5.3	3.8	NA
E533	NA	8.8	4.0	NA
E3309	1.5	7.7	2.3	0.1
LJ20	1.7	4.8	3.9	0.1

E = Etowah LJ = Lake Jackson

APPENDIX C
MISSISSIPPIAN COPPER ARTIFACTS
TABLE #6: FEATHER SYMBOL BADGES

ARTIFACT #	WEIGHT GR.	LENGTH(CM)	WIDTH(CM)	THICK.(CM)
E1146-5	3.	9.1	4.5	0.1
E1146-6	8.7	14.0	4.4	0.1
E1146-7	7.5	15.0	3.5	0.1
E1146-8	NA	9.2	4.7	NA
E1146-9	NA	9.4	4.2	NA
E1146-10	NA	10.0	4.2	NA
E1146-11	NA	9.5	3.8	NA
E1146-12	NA	9.4	4.2	NA
E1146-13	NA	9.0	4.2	NA

E = Etowah

APPENDIX C
MISSISSIPPIAN COPPER ARTIFACTS
TABLE #7: RAPTOR TALON SYMBOL BADGES

ARTIFACT #	WEIGHT GR.	LENGTH(CM)	WIDTH(CM)	THICK.(CM)
E1146-3	5.0	8.8	4.9	0.1
E1146-4	2.4	8.8	4.3	0.1

E = Etowah

APPENDIX C
MISSISSIPPIAN COPPER ARTIFACTS
TABLE #8: COPPER HEADDRESSES

ARTIFACT #	WEIGHT GR.	LENGTH(CM)	WIDTH(CM)	THICK.(CM)
E442-1	NA	22.8	20.0	NA
E442-2	68.9	7.8	7.8	5.0
E442-3	48.1	7.5	7.5	5.1
E463	NA	25.0	24.0	NA
E483	NA	20.3	4.0	NA
E910	4.1	6.4	6.4	0.1
E1141	15.3	23.0	6.5	0.1
E1146-1	21.0	19.0	17.3	0.1
E1146-2	29.7	25.5	20.0	0.1
E1591	6.0	9.0	8.0	0.1
E1723	19.1	12.0	4.5	0.8

E = Etowah

APPENDIX C
MISSISSIPPIAN COPPER ARTIFACTS
TABLE #9: RAPTOR BEING PLAQUES

ARTIFACT #	WEIGHT GR.	LENGTH(CM)	WIDTH(CM)	THICK.(CM)
E1718	NA	40.6	19.0	NA
E1719	NA	34.0	12.5	0.1
LJ4148	NA	54.0	23.0	NA
LJ4149	NA	57.0	15.0	NA
LJ4731	NA	40.6	19.0	NA

E = Etowah LJ = Lake Jackson

APPENDIX C
MISSISSIPPIAN COPPER ARTIFACTS
TABLE #10: RAPTOR DISHES

ARTIFACT #	WEIGHT GR.	LENGTH(CM)	WIDTH(CM)	THICK.(CM)
LJ11	129.2	31.0	14.0	0.1
LJ12-1	79.5	29.5	11.0	0.1
LJ12-2	3.2	8.2	2.6	0.1
LJ12-3	9.3	7.5	6.5	0.1
LJ13-1	99.7	32.0	14.0	0.1
LJ13-2	1.5	5.1	2.0	0.1
LJ13-3	1.5	5.2	3.0	0.1
LJ14-1	37.6	14.5	10.2	0.1
LJ14-2	102.0	22.5	15.4	0.1
LJ14-3	30.3	14.7	11.0	0.1
LJ14-4	27.8	18.3	7.5	0.1

LJ = Lake Jackson

APPENDIX C
MISSISSIPPIAN COPPER ARTIFACTS
TABLE #11: EARSPOOLS

ARTIFACT #	WEIGHT GR.	LENGTH(CM)	WIDTH(CM)	THICK.(CM)
E378-1	3.0	4.4	4.4	1.3
E378-2	1.6	4.0	4.0	1.6
E378-3	3.2	3.6	3.6	0.4
E788-1	4.7	4.4	4.4	0.5
E788-2	2.3	3.9	3.9	0.5
E1147-1	8.7	4.6	4.6	1.0
E1147-2	6.2	5.2	5.2	0.5
E1147-3	9.3	4.8	4.8	1.0
E1148-7	5.2	3.8	3.8	0.9
E1148-8	4.0	3.8	3.8	0.9
E1231	4.2	4.2	4.2	0.8
E1532-4	13.5	6.2	5.5	1.2
E1532-5	18.2	6.2	6.2	1.1
E1571	2.1	3.3	3.3	0.8
E1572-1	5.5	4.4	4.4	0.5
E1572-2	4.2	4.2	4.2	0.7
E1573	2.7	4.5	4.5	0.1
E1596-1	8.2	6.2	6.2	0.1
E1596-2	3.9	4.8	4.8	0.1
E2061-1	3.6	NA	NA	NA
E2061-2	3.6	4.9	4.9	0.7
E3033	3.0	4.5	4.5	1.7
E3305	3.2	4.5	4.5	NA
E3598-1	3.2	4.8	4.8	0.7
E3598-2	3.4	4.9	4.9	0.7

E = Etowah

APPENDIX C
MISSISSIPPIAN COPPER ARTIFACTS
TABLE #12: EFFIGY RATTLES

ARTIFACT #	WEIGHT GR.	LENGTH(CM)	WIDTH(CM)	THICK.(CM)
E5981-1	4.2	5.4	2.4	2.2
E5981-2	3.5	4.6	2.4	2.0
E1150-1	11.8	8.2	1.8	1.8
E1150-2	12.9	8.5	2.2	2.2
E1150-3	10.5	8.0	2.4	2.4
E1150-4	9.5	7.2	2.1	2.1
E1150-5	10.6	8.1	2.2	2.2
E1150-6	11.7	8.6	1.8	1.8
E1150-7	9.5	8.2	2.1	2.1
E1150-8	7.6	7.8	1.7	1.7
E1150-9	10.1	8.2	2.0	2.0
E2536	2.4	6.6	1.7	0.3

E = Etowah

APPENDIX C
MISSISSIPPIAN COPPER ARTIFACTS
TABLE #13: COPPER CLAD BODKINS

ARTIFACT #	WEIGHT GR.	LENGTH(CM)	WIDTH(CM)	THICK.(CM)
E783-1	--	10.7	2.7	0.3
E783-2	--	16.7	2.0	0.3
E783-3	--	8.8	2.0	0.2

Agregate total weight: 16.2 grams E = Etowah

APPENDIX C
MISSISSIPPIAN COPPER ARTIFACTS
TABLE #14: COPPER CLAD FINIALS

ARTIFACT #	WEIGHT GR.	LENGTH(CM)	WIDTH(CM)	THICK.(CM)
E1712	5.7	6.1	3.5	0.5
E1715	1.5	5.4	2.6	1.4
E1729-1	5.5	6.7	3.0	0.6
E1729-2	3.1	4.4	3.0	0.4

E = Etowah

APPENDIX C

MISSISSIPPIAN COPPER ARTIFACTS

TABLE #15: COPPER GORGETS

ARTIFACT #	WEIGHT GR.	LENGTH(CM)	WIDTH(CM)	THICK.(CM)
E463-1	NA	16.0	16.0	NA
E782	4.5	6.5	6.5	0.5
E1887	6.0	5.2	5.2	0.6
E2651	NA	21.7	21.7	NA

E = Etowah

APPENDIX C
MISSISSIPPIAN COPPER ARTIFACTS
TABLE #16: COPPER BEADS

ARTIFACT #	WEIGHT GR.	LENGTH(CM)	WIDTH(CM)	THICK.(CM)
E1888-1RT	1.3	2.2	0.6	0.6
E1888-2RT	1.2	2.2	0.6	0.6
E1888-3H	0.9	2.8	2.8	1.4
E1888-4H	1.4	3.0	3.0	2.2
E2062-3H	0.3	1.0	1.0	0.3
E2062-4H	0.4	1.2	1.2	0.4
E2062-5H	0.6	1.2	1.2	0.6
E2062-6H	0.2	NA	NA	NA

RT = Rolled Tube bead H = Hollow bead E = Etowah

APPENDIX C
MISSISSIPPIAN COPPER ARTIFACTS
TABLE #17: COPPER AXES

ARTIFACT #	WEIGHT GR.	LENGTH(CM)	WIDTH(CM)	THICK.(CM)
E560	449.0	16.3	7.5	0.8
E561-1	276.4	23.0	7.0	0.6
E563	646.0	22.3	9.5	0.8
E568	435.6	17.0	6.5	0.8
E568-2	373.6	16.0	15.5	0.6
E578	401.1	18.5	8.5	0.6
E642	213.2	20.0	4.5	0.6
E836	216.4	12.7	4.8	0.6
E839	63.2	12.0	4.0	0.3
E1562	439.0	22.0	8.3	0.6
LJ15	941.0	19.5	7.8	1.8
LJ16	434.8	18.8	5.4	0.5
LJ17	578.0	19.8	6.5	0.7
LJ2846(Lab#)	380.9	19.5	6.4	0.7
LJ2847(Lab#)	567.4	20.7	7.8	0.4

E = Etowah LJ = Lake Jackson

APPENDIX D
ILLUSTRATIONS

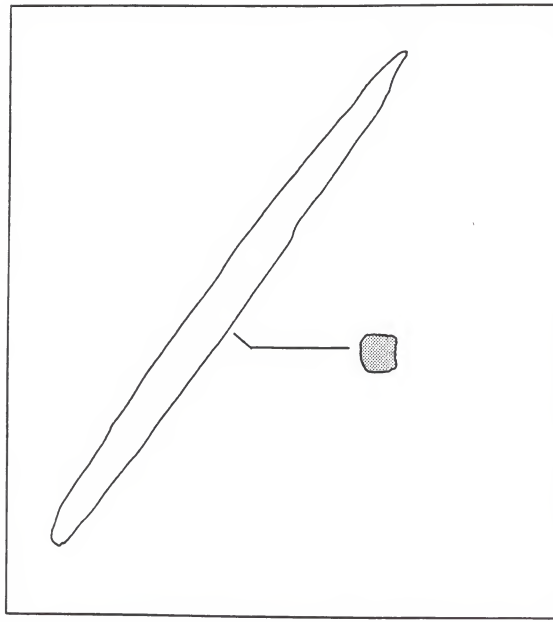

Figure 1. Old Copper Industries Collection Copper Bar. FMNH# 52342. Scale 1:1.

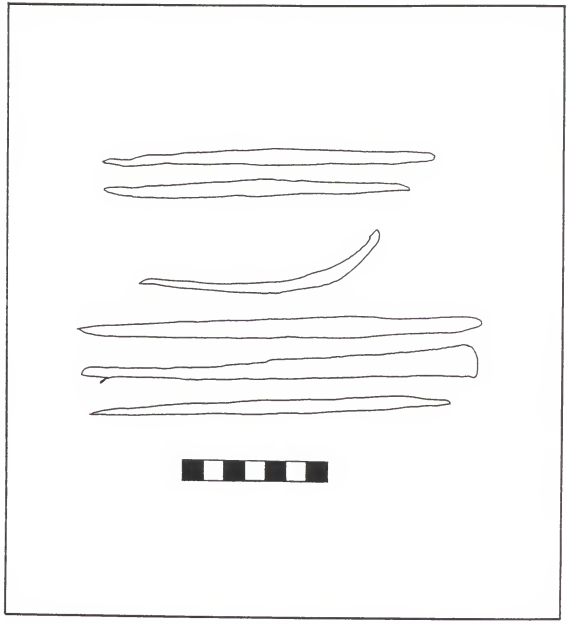

Figure 2. Old Copper Industries Collection Piercing Implements. FMNH#s:(top to bottom)52181, 52183, 52190, 52186, 68058, 68059. Scale cm.

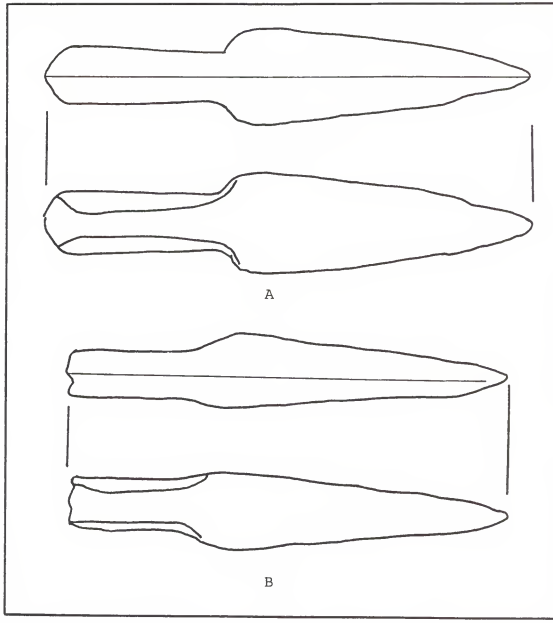

Figure 3. Old Copper Industries Collection Socketted Triangular Spear Points. A - FMNH# 52011, B - FMNH# 52013.
Scale 1:1

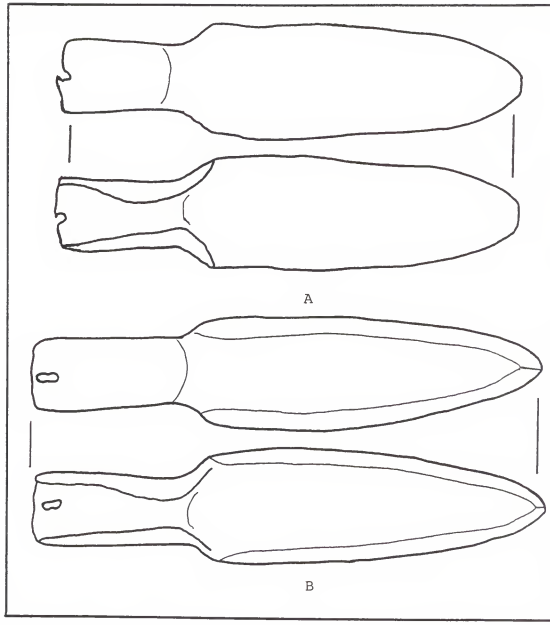

Figure 4. Old Copper Industries Collection Socketted Oval Spear Points. A - FMNH# 52041, B - FMNH# 168179.
Scale 1:1.

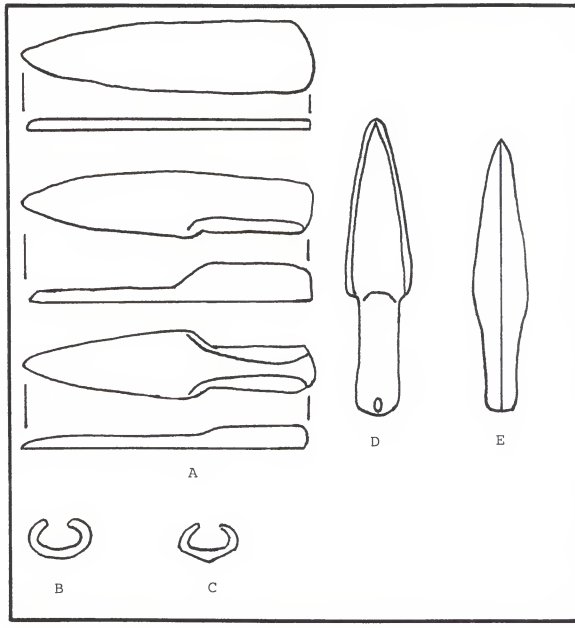

Figure 5. Old Copper Industries Socketted Spear Point Manufacture. A - Manufacture Sequence B - Cross-section Oval Spear Point Socket C - Cross-section Triangular Spear Point Socket D - Oval Spear Point E - Triangular Spear Point.

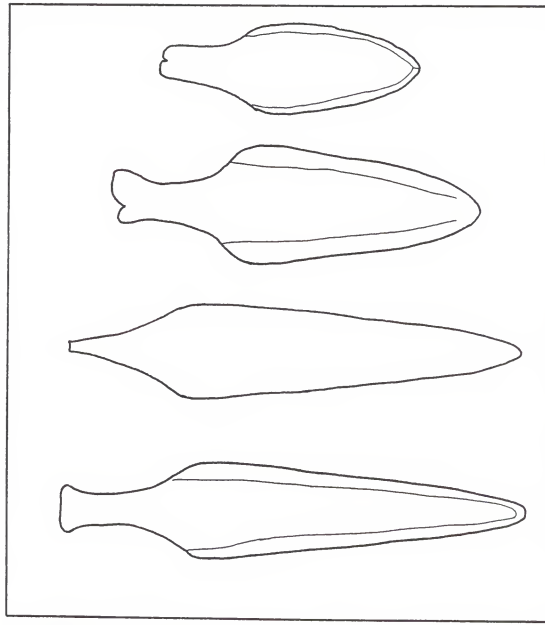

Figure 6. Old Copper Industries Collection Tanged Spear Points. FMNH#s: (top to bottom) 52015, 52016, 52045, 52029. Scale 1:1.

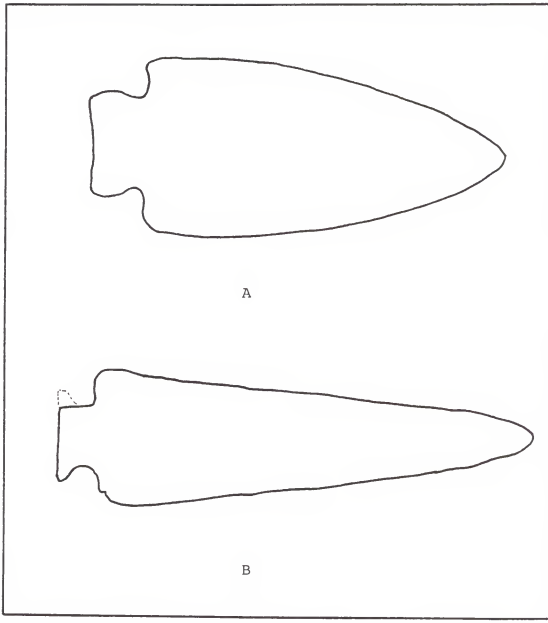

Figure 7. Old Copper Industries Collection Notched Spear Points. A - FMNH# 52223, B - FMNH# 68012.
Scale 1:1.

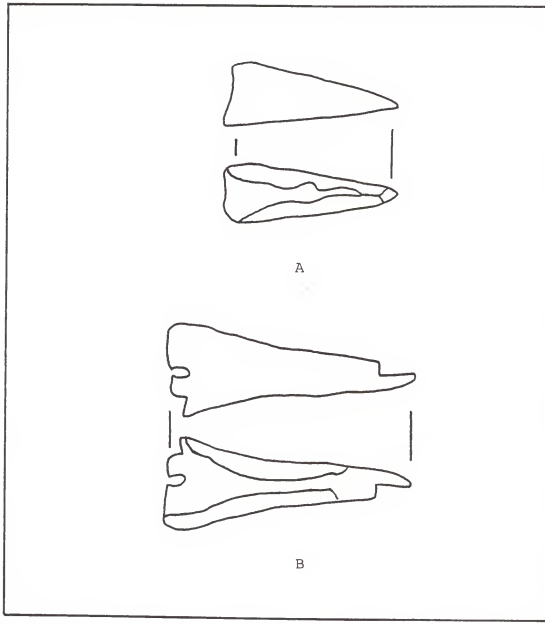

Figure 8. Old Copper Industries Collection Rolled Cone Spear Points. A - FMNH# 68150, B - FMNH# 68112.
Scale 1:1.

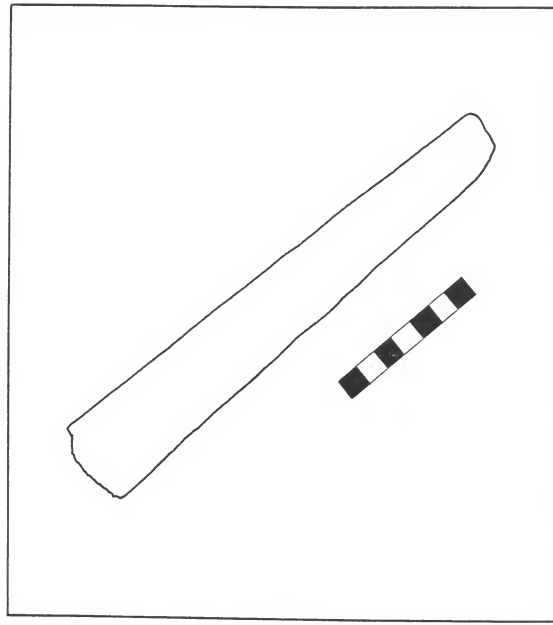

Figure 9. Old Copper Industries Collection Square Edged Celt. FMNH# 52175. Scale cm.

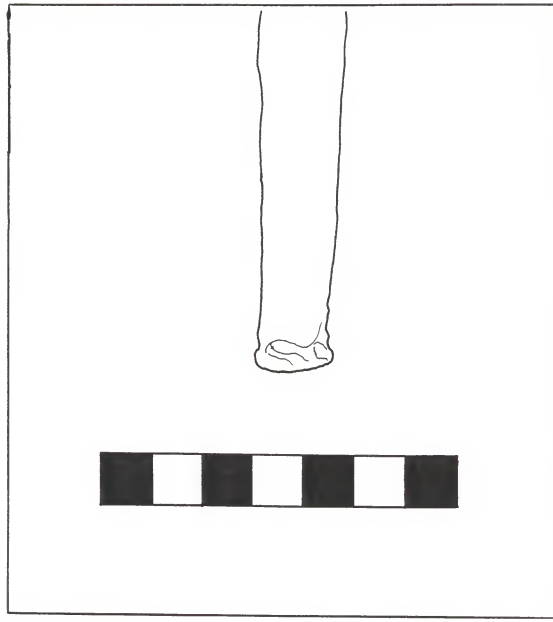

Figure 10. Old Copper Industries Collection Square Edged Celt With Upended Poll. FMNH# 52170. Scale cm.

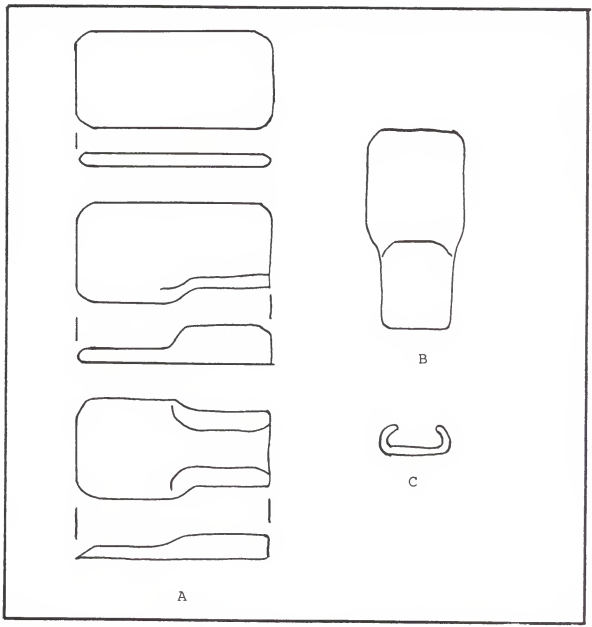

Figure 11. Old Copper Industries Collection Socketted Celt Manufacture. A - Manufacture Sequence B - Top View Of Socketted Celt C - Cross-section of Celt Socket.

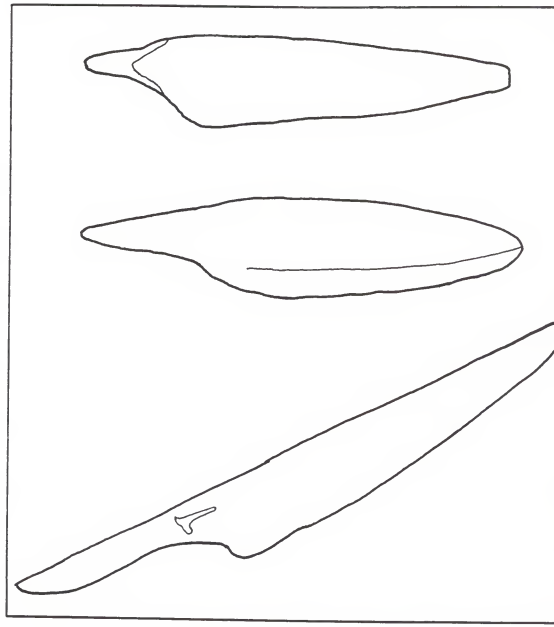

Figure 12. Old Copper Industries Collection Flat Knives. FMNH#s: (top to bottom) 52077, 52260, 168186. Scale 1:1.

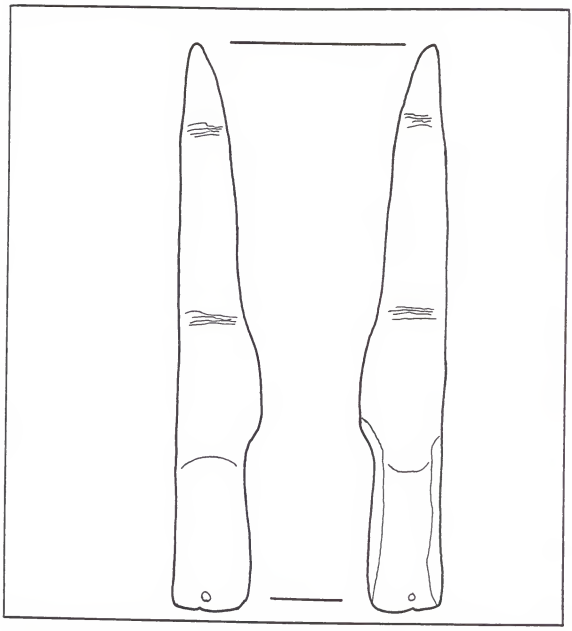

Figure 13. Old Copper Industries Collection Socketted Knife. FMNH# 52123. Scale 1:1.

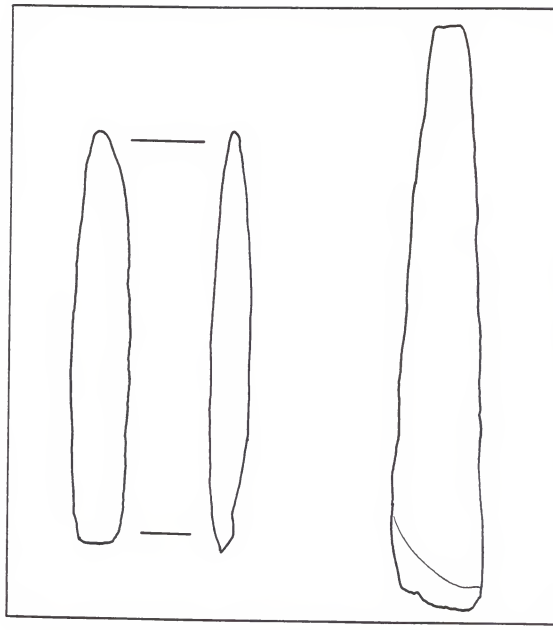

Figure 14. Old Copper Industries Collection Chisels.
Left - FMNH# 52296, Right - 52204.
Scale 1:1.

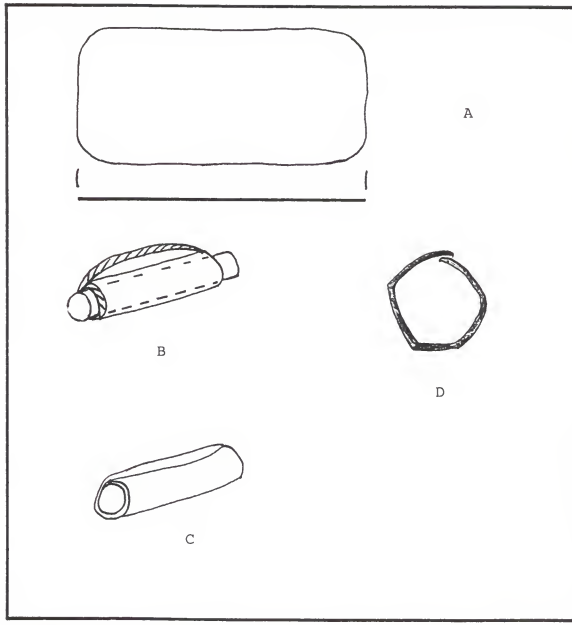

Figure 15. Rolled Copper Tube Bead Manufacture. A - Hammered Copper Sheet B - Rolling Tube Bead On Mandrel C - Finished Rolled Tube Bead D - Cross-section Of Rolled Tube Bead Showing Yield Point Structures.

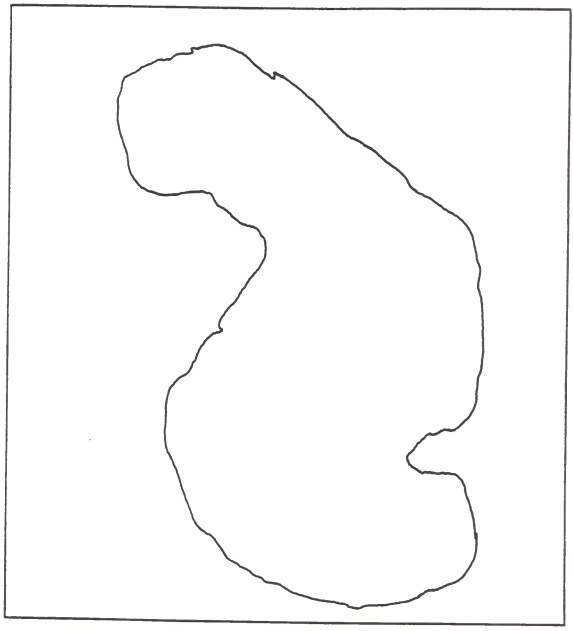

Figure 16. Hopewell Collection Unmodified Copper Nugget. FMNH# 53037. Scale 1:1.

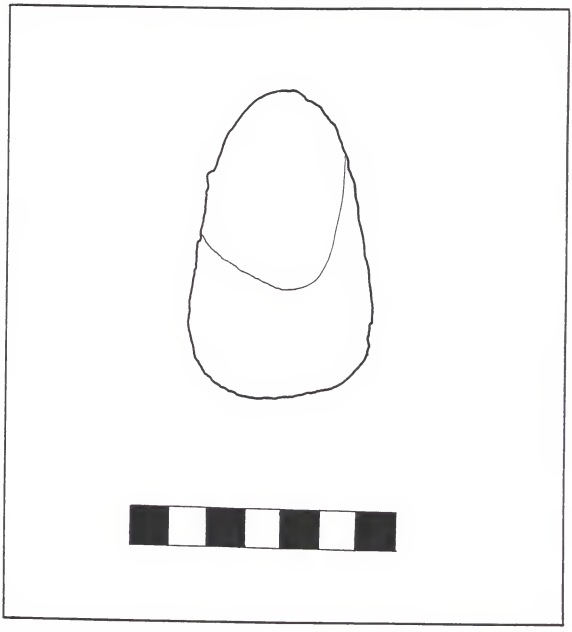

Figure 17. Hopewell Collection Modified Copper Nugget Hammerstone. FMNH# 56134. Scale 1:1.

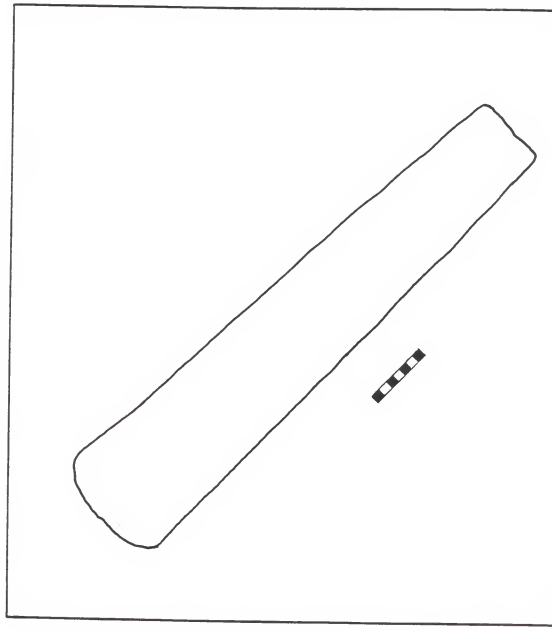

Figure 18. Hopewell Collection Large Copper Axe.
FMNH# 56297.
Scale cm.

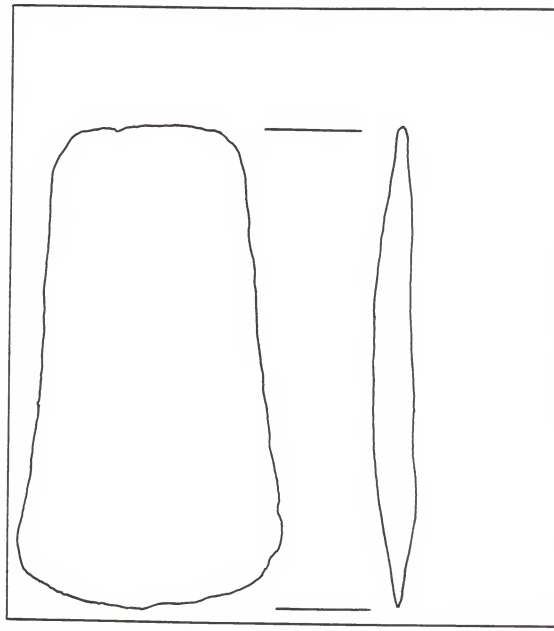

Figure 19. Hopewell Collection Copper Celt.
FMNH# 56246.
Scale 1:1.

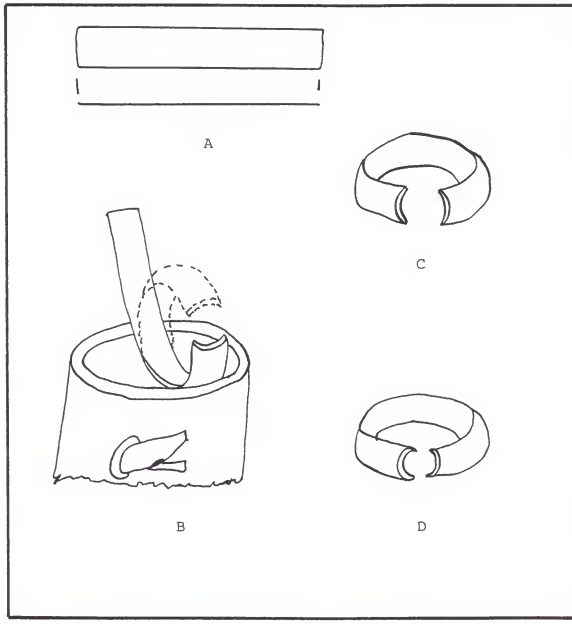

Figure 20. Hopewell Collection Hollow Copper Bracelet Manufacture. A - Flat Copper Strip B - Shaping The Metal Strip In The Wooden Form C - Wide "U" Bracelet As It Comes From The Wooden Form D - Finished Bracelet.

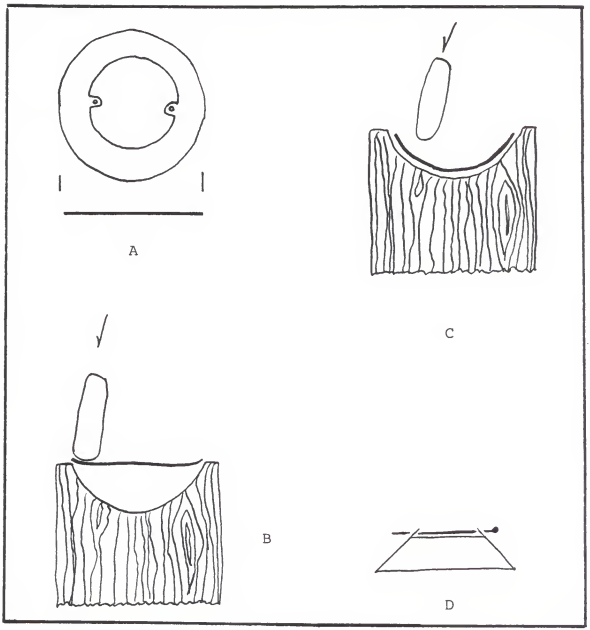

Figure 21. Hopewell Collection Copper Brooch Manufacture. A - Prepared Flat Sheet B - Hammering The Sheet Into A Wooden Form C - Sunken Sheet D - Finished Brooch Showing Pin Position.

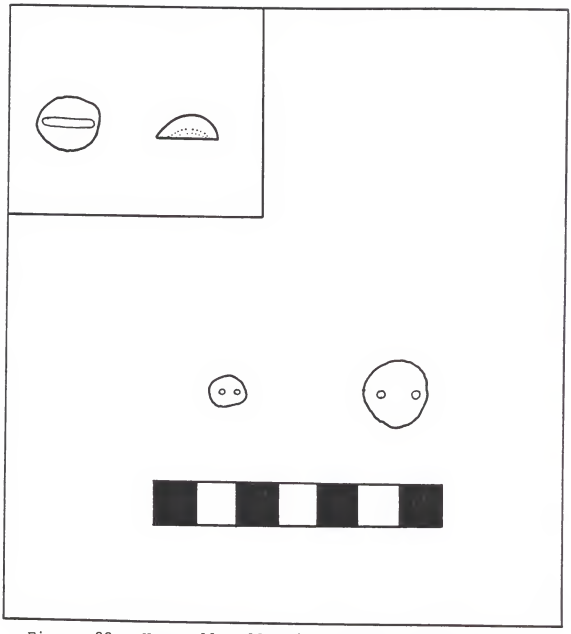

Figure 22. Hopewell Collection Copper Clad Buttons. FMNH Lot # 56088. Insert Shows Thread Channel.
Scale cm.

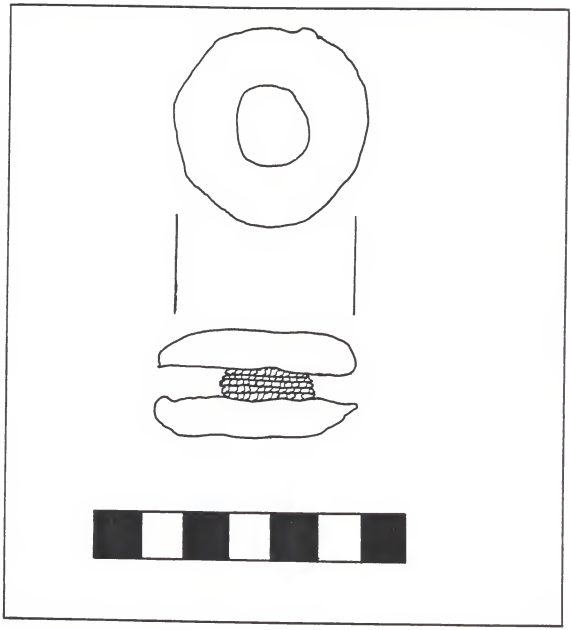

Figure 23. Hopewell Collection Copper Earspool. FMNH# 56061.
Scale cm.

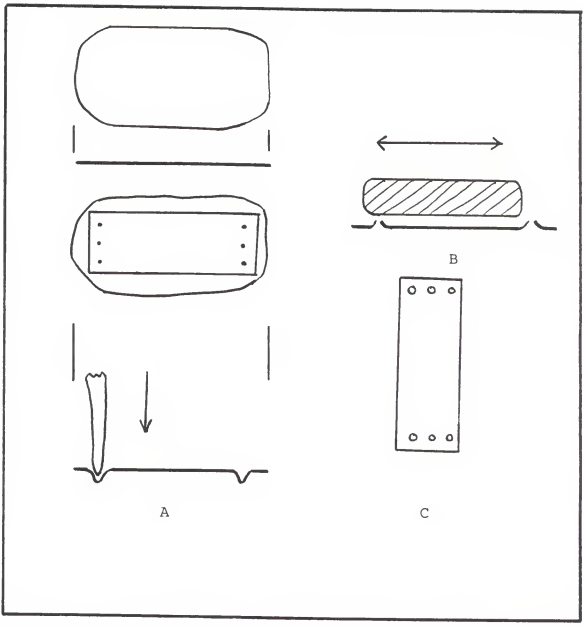

Figure 24. Hopewell Collection Copper Strip Manufacture. A - Outlining The Strip In The Hammered Copper Sheet B - Grinding Through The Raised Metal C - The Finished Copper Strip.

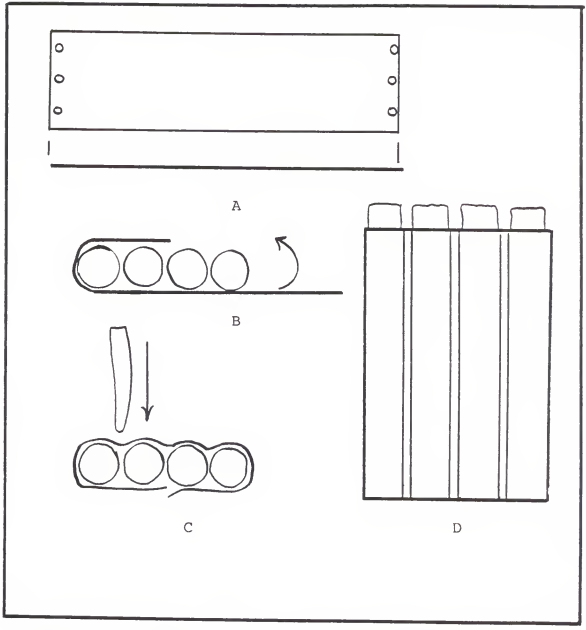

Figure 25. Hopewell Collection Panpipe Manufacture. A - Prepared Copper Strip B - The Strip Being Wrapped Around The Tubes Of The Panpipe C - Indentation Of The Metal Between The Tubes D - The Finished Panpipe.

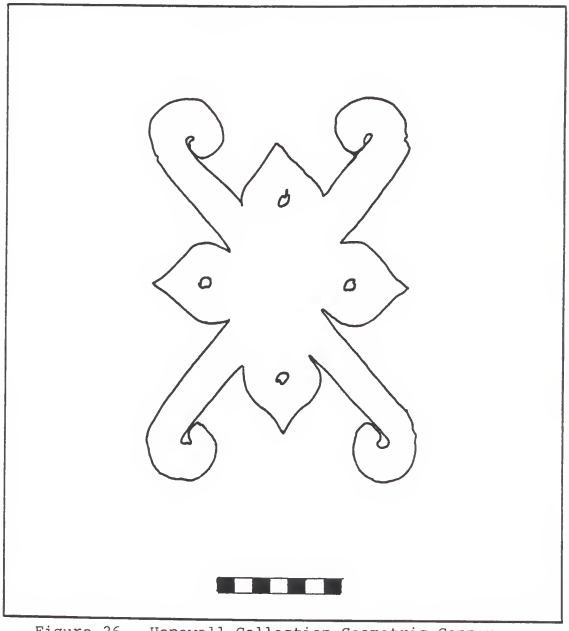

Figure 26. Hopewell Collection Geometric Copper Cut-out. FMNH# 56163. Scale cm.

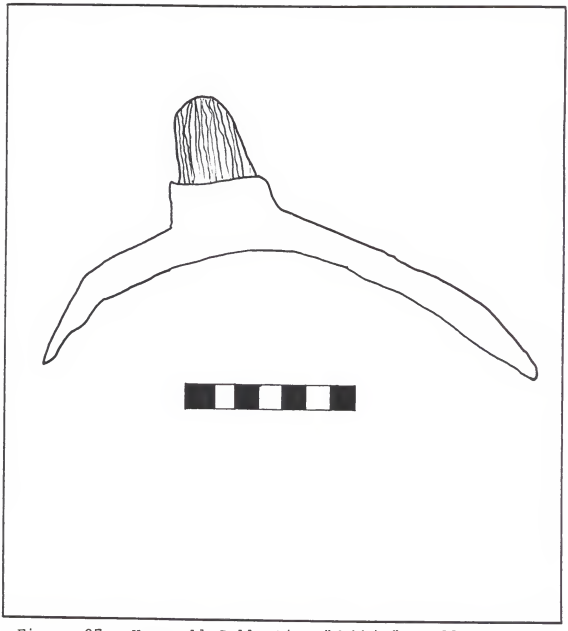

Figure 27. Hopewell Collection "Nubbin" Headdress.
FMNH# 56364.
Scale cm.

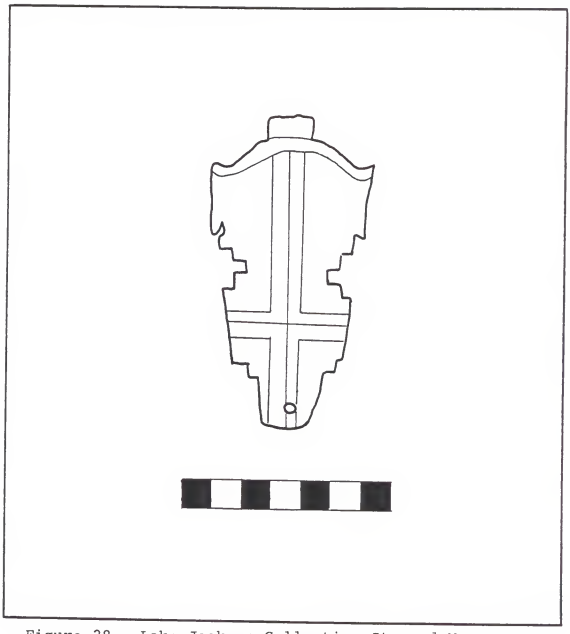

Figure 28. Lake Jackson Collection Stepped Mace Symbol Badge. LJ#8. Scale cm.

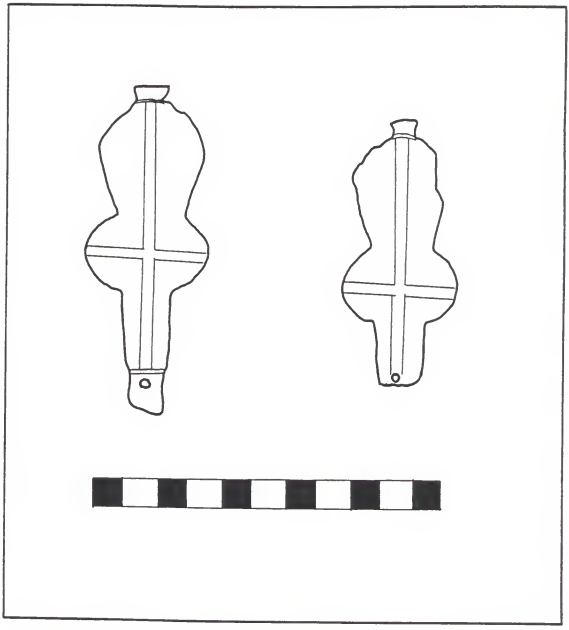

Figure 29. Etowah Collection Plain Mace Symbol Badges. Etowah#s: (left to right) 733-1, 733-6.
Scale cm.

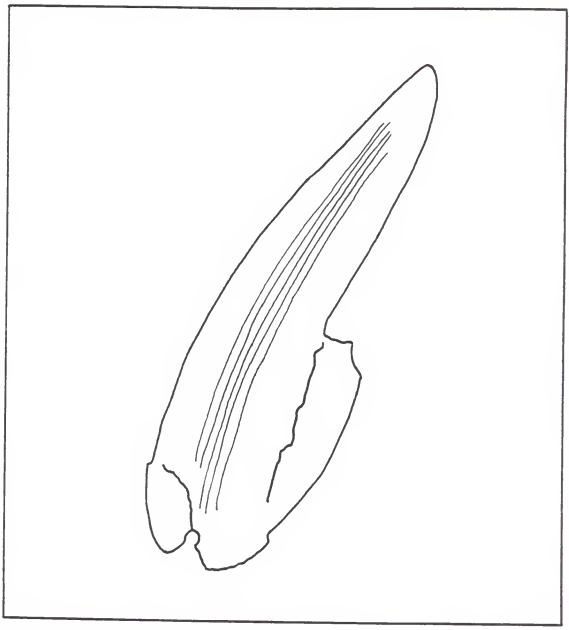

Figure 30. Etowah Collection Feather Symbol Badge.
Etowah# 1146-7.
Scale 1:1

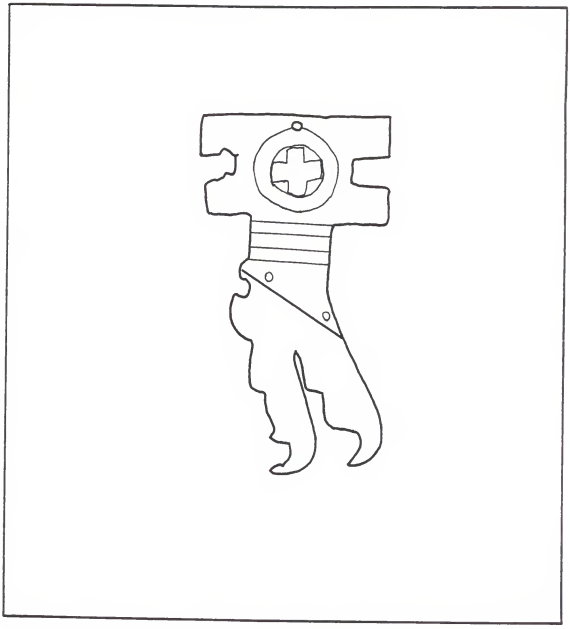

Figure 31. Etowah Collection Rapto Talon Symbol Badge. Etowah# 1146-3.
Scale 1:1

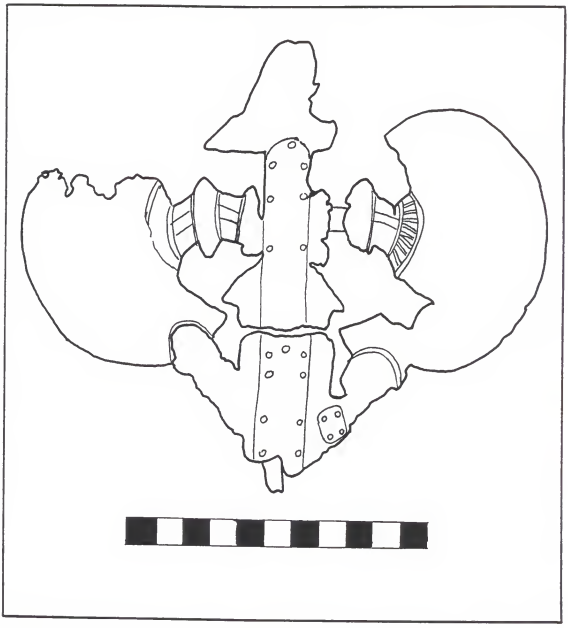

Figure 32. Etowah Collection Bilobed Headdress. Etowah# 1723. Scale cm.

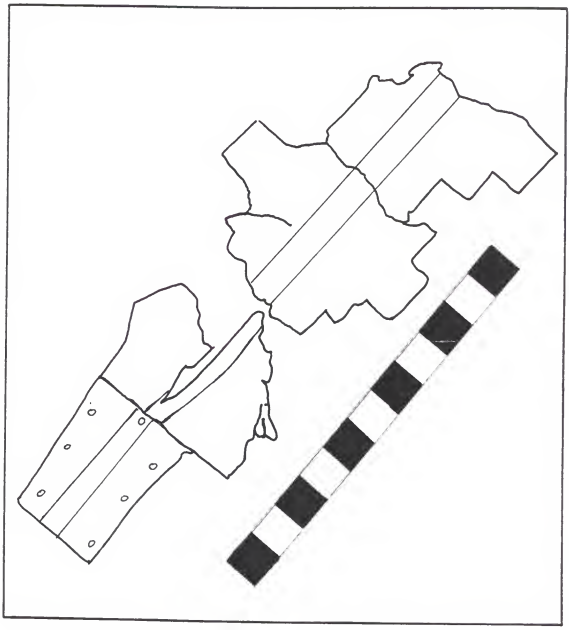

Figure 33. Etowah Collection Mace Headdress.
Etowah# 1141.
Scale cm.

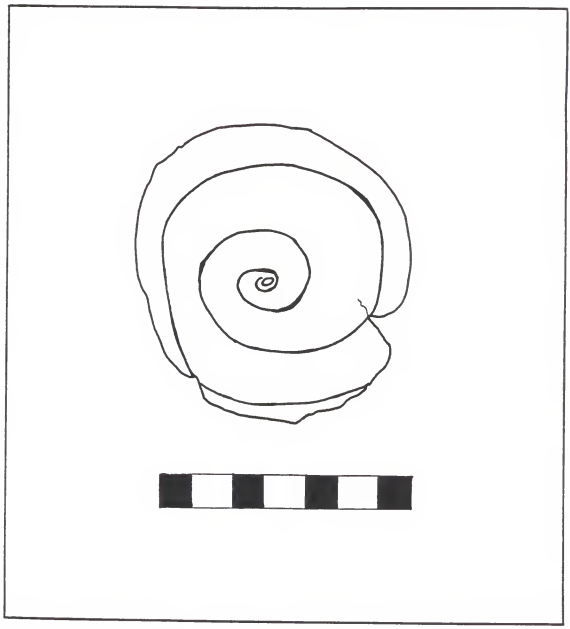

Figure 34. Etowah Collection Effigy Shell Headdress. Etowah# 1146-1. Scale cm.

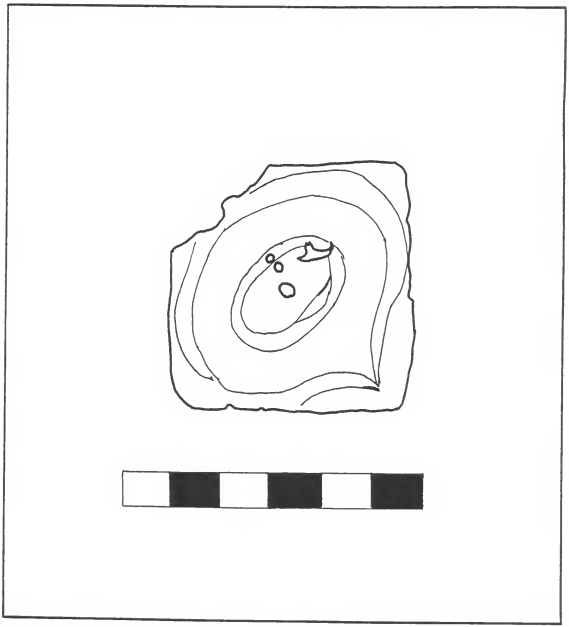

Figure 35. Etowah Collection Ogee Eye Headdress.
Etowah# 910.
Scale cm.

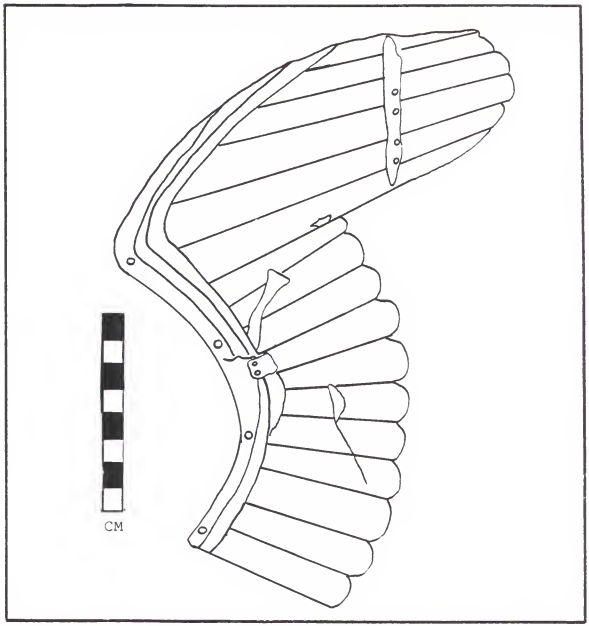

Figure 36. Etowah Collection Raptor Wing Headdress. Scale cm.

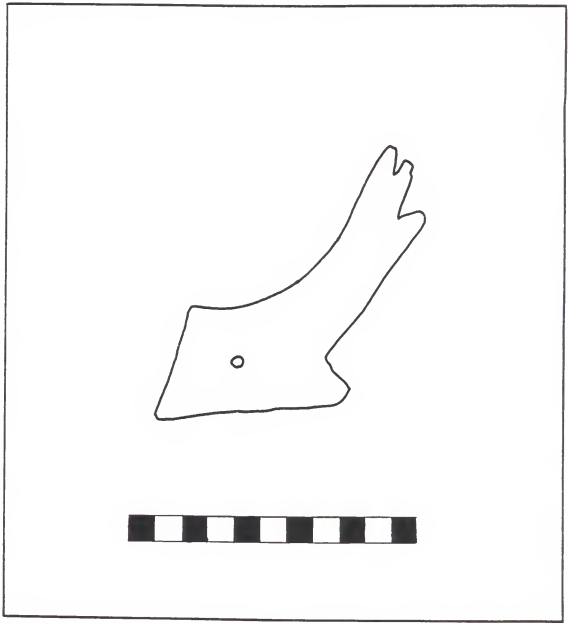

Figure 37. Etowah Collection Antler From Deer Mask Headdress. Etowah# 1723. Scale cm.

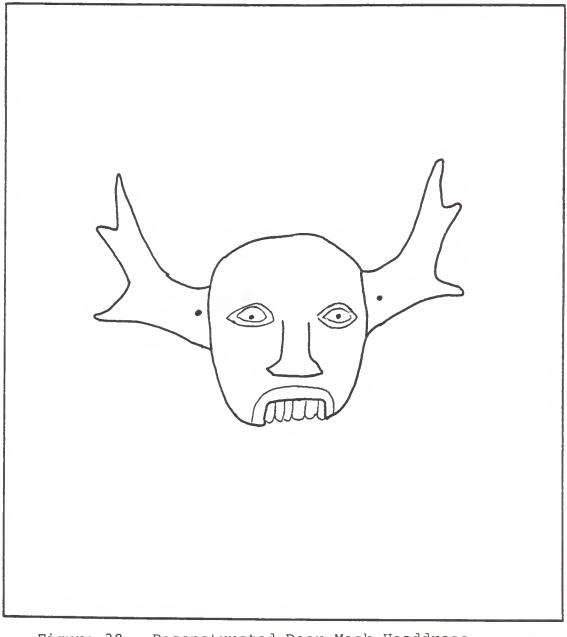

Figure 38. Reconstructed Deer Mask Headdress.

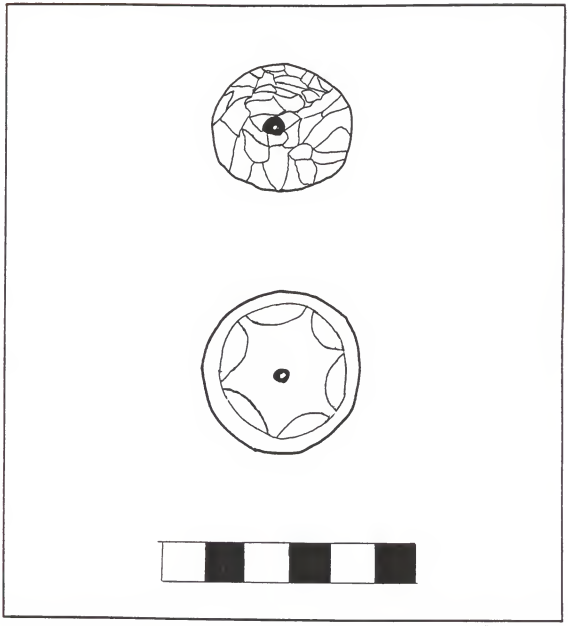

Figure 39. Etowah Collection Earspools. Etowah#s: (top to bottom) Unknown, 1147. Scale cm.

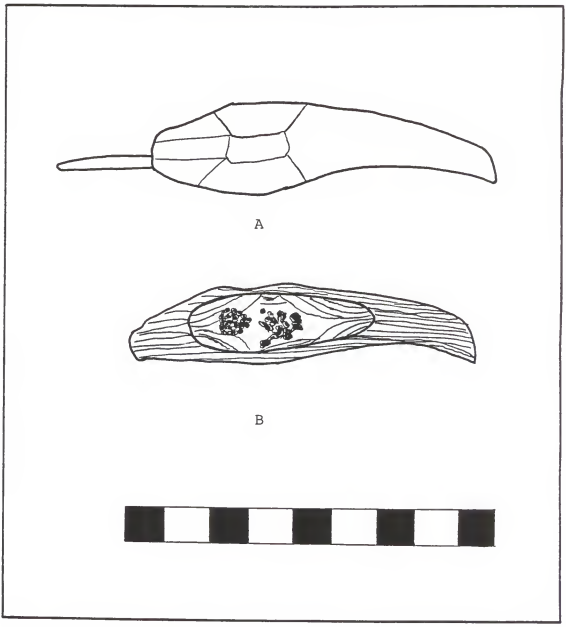

Figure 40. Etowah Collection Raptor Talon/Bird Head Rattle. A - Exterior Of Rattle With Attached Handle B - Interior Of Rattle Showing Quartz Grains. Etowah# 598l-l. Scale cm.

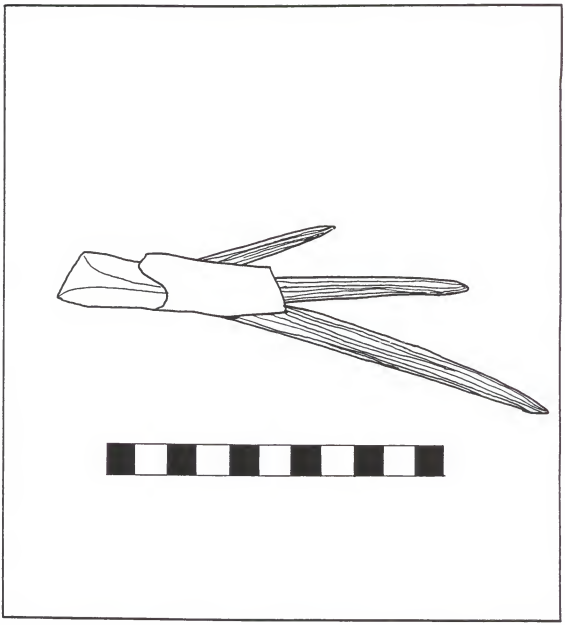

Figure 41. Etowah Collection Copper Clad Bodkins.
Etowah# 783.
Scale cm.

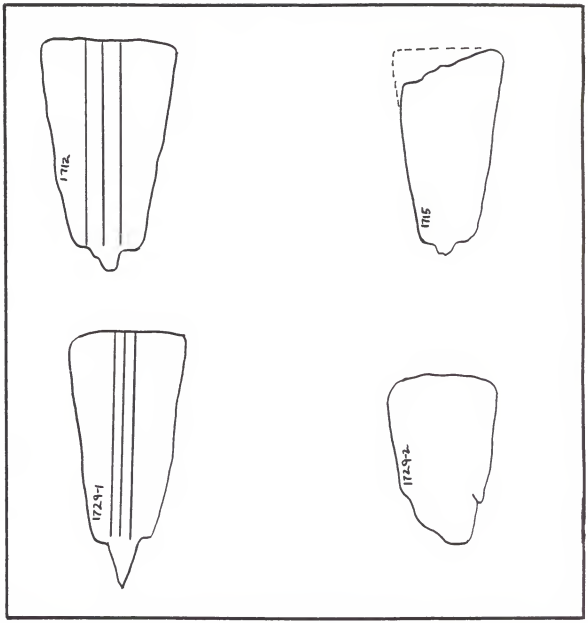

Figure 42. Etowah Collection Copper Clad Wooden Finials. Scale 1:1.

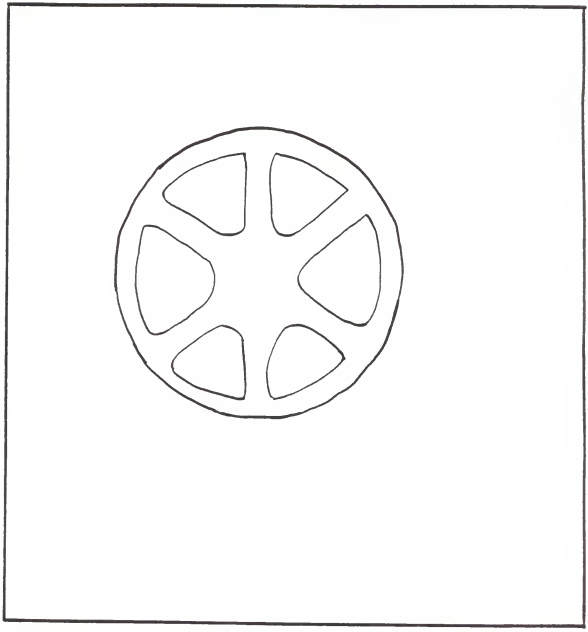

Figure 43. Etowah Collection Copper Clad Sun Gorget, Reconstructed. Scale 1:1.

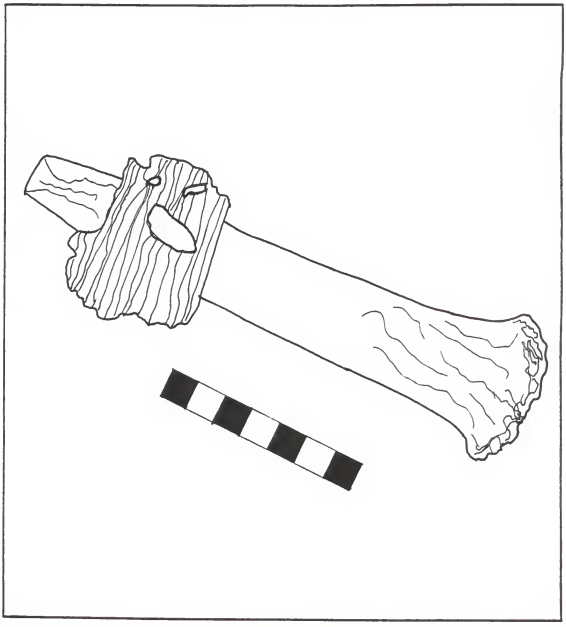

Figure 44. Etowah Collection Copper Axe With Partial Wood Haft. Etowah# 561. Scale cm.

APPENDIX E
PHOTOGRAPHS

Figure 1. Old Copper Industries Collection Socketed Celts. FMNH#s: (top to bottom) 68077, 68079, 52229, 52235.

Figure 2. Tommograph Of Hopewell Collection Large Copper Axe. FMNH# 56297. Note Modified Void On Left Caused By Hammering.

Figure 3. Hopewell Collection Bracelets. Hollow Bracelet On Left - FMNH# 56140. Solid Bracelet On Right FMNH# 56143.

Figure 4. Hopewell Collection Hollow Bracelet On Edge.

Figure 5. Hopewell Collection Copper Brooches. FMNH#s: (left to right) 56152, 56151. Note The Extant Tab On FMNH# 56151.

Figure 6. Hopewell Collection Copper Clad Sandstone Beads.

Figure 7. Hopewell Collection Copper Breastplate. FMNH# 56082. Note Fur And Textile Marks.

Figure 8. Hopewell Collection Copper Effigy.
FMNH# 56174.

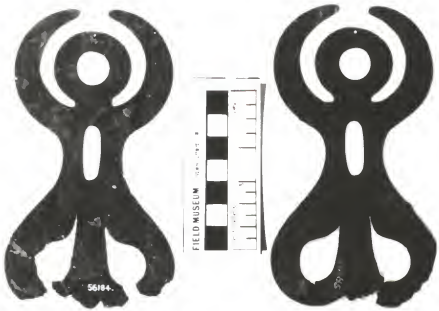

Figure 9. Hopewell Collection Geometric Copper Cut-outs. FMNH#s: (left to right) 56184, 56185.

Figure 10. Tools Used To Replicate A Geometric Copper Cut-out. Clockwise From The Top Left: A Large Antler Bosser, A fine Line Antler Bosser, A Granite River Cobble, A Sandstone Abrader.

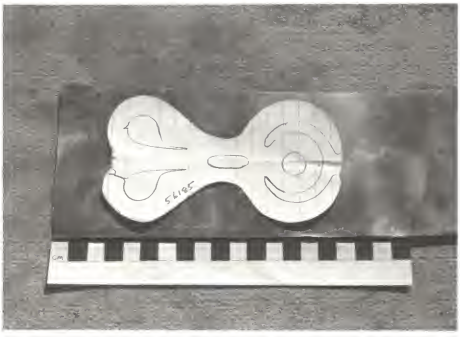

Figure 11. The Template Made From FMNH# 56185 On Top Of The Hammered Copper Sheet.

Figure 12. The Replica Partially Finished.

Figure 13. The Bottom Portion Embossed And One Element Removed By Grinding.

Figure 14. The Finished Geometric Copper Cut-out After Polishing With Animal Fat And Sifted Wood Ash.

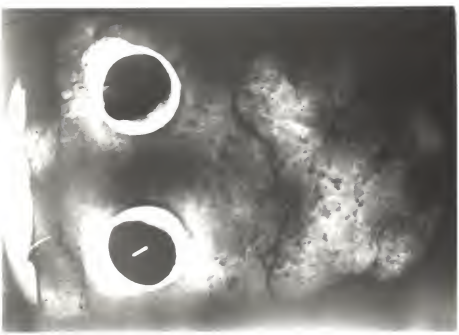

Figure 15. Xeroradiograph Of Hopewell Collection "Nubbin" Headdress. FMNH# 56364.

Figure 16. Etowah Collection Copper Arrow Symbol Badge. Etowah# 541.

Figure 17. Xeroradiograph Of Raptor Talon Symbol Badge (FMNH# 1146-3) And Feather Symbol Badge (Etowah# 1146-7).

Figure 18. Xeroradiograph Of Bilobed Copper Headdress (Etowah# 1723). Note Patch Over Crack In Upper Left.

Figure 19. Lake Jackson Collection Raptor Dish. LJ# 11.

Figure 20. Photomicrograph Of Shark's Teeth Marks On Carved Earspool (Etowah# 1147).

Figure 21. Xeroradiograph Of Hafted Copper Axe (Etowah# 561). Note "I" Beam Construction Resulting From Hammering Down The Center To Widen The Blade.

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BIOGRAPHICAL SKETCH

Jonathan Max Leader was born in Rochester, New York, on May 3, 1955. His family are avid travellers and he spent his summers travelling through the United States, Canada, and Mexico. The different people and cultures he met awakened an early interest in anthropology. This interest is shared and supported by his family. At 17, he briefly lived in Israel and became involved in three excavations. He also took the opportunity to travel in the Sinai with some Bedouin friends, and later crossed the length of the Negev desert alone and on foot. In 1978, he studied the Siruhanos of Guam and obtained his B.A. from Western Michigan University. An invitation to continue his studies on Guam resulted in his return there in 1979 and he participated in a number of projects for the Office of the Territorial Archaeologist, War in the Pacific National Historical Park, and the University of Guam. He returned to the mainland United States in 1981 and received his M.A. from the University of Florida in 1985.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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